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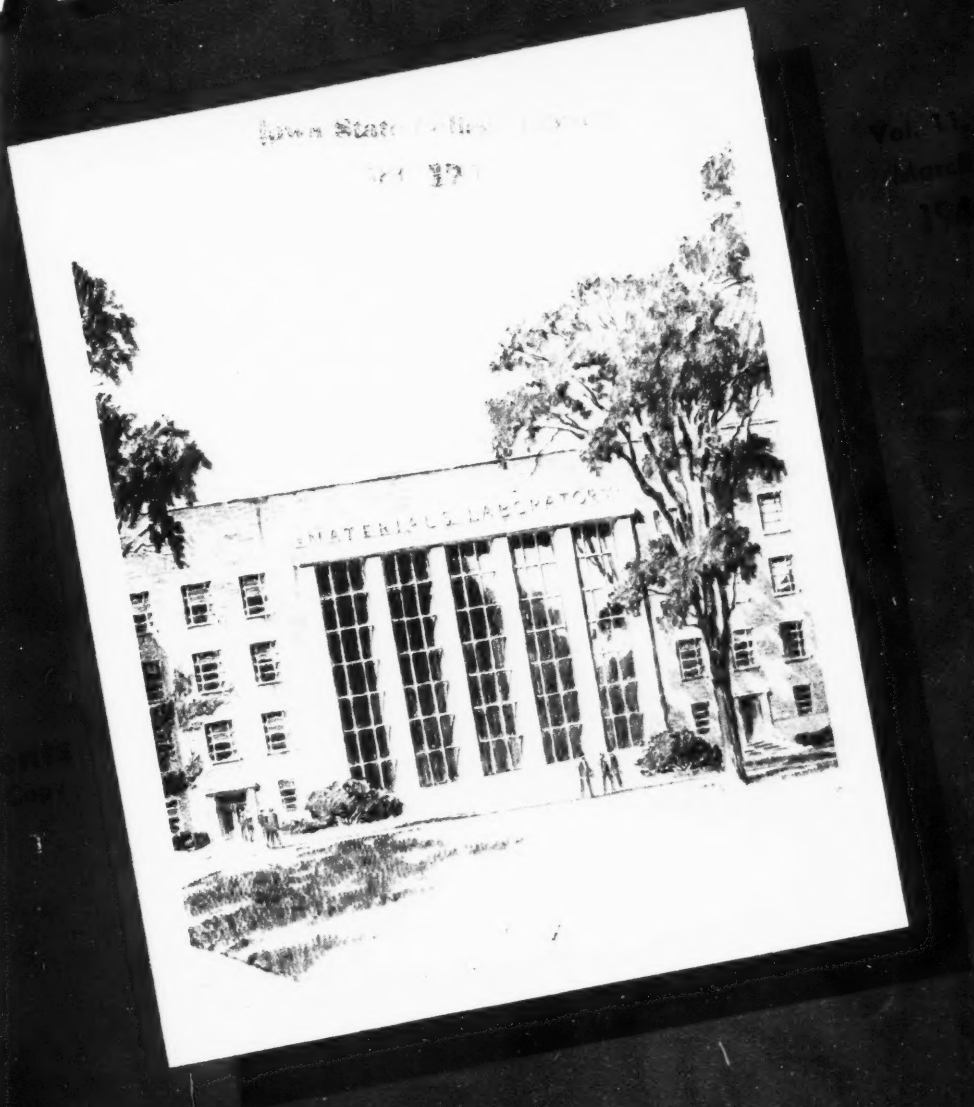

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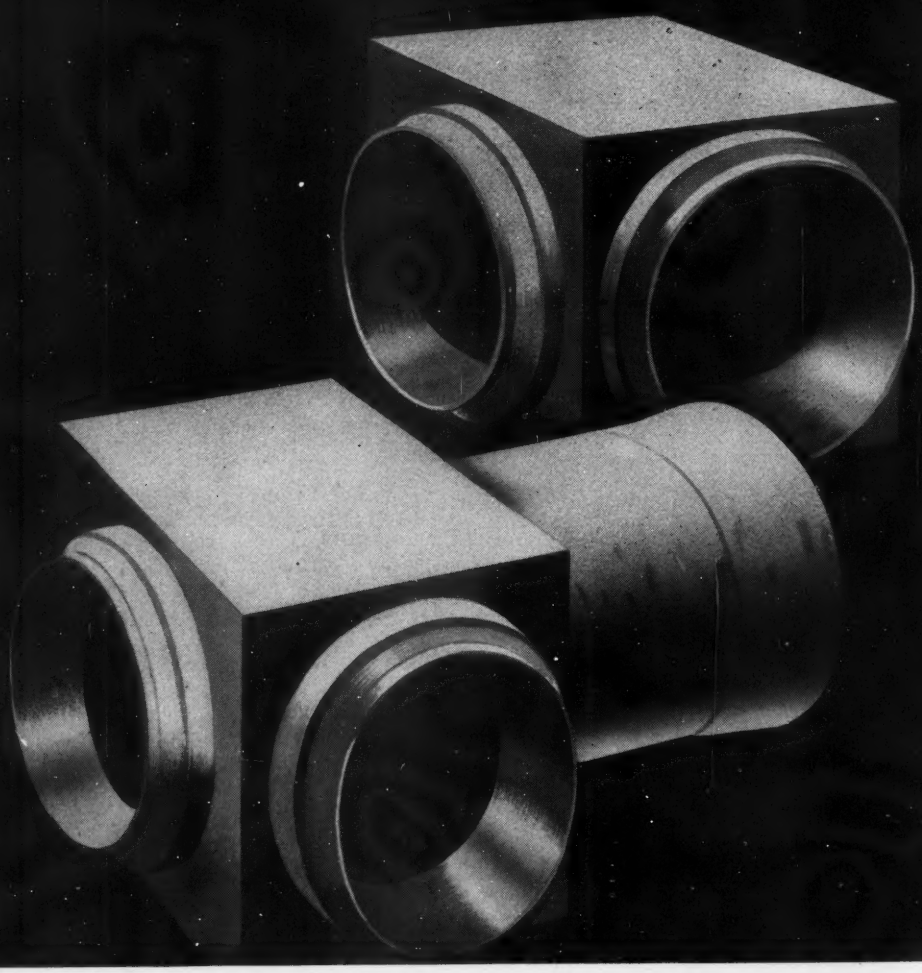

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CONTENTS

Aeronautical Laboratory 7
Dr. C. C. Furnas

The Engineer's Role in Railroads 10
A. H. Ayers, M.E. '00 and A. D. Peters

The Engineer and Organized Labor 13
Hugh L. Meyers, ChemE '48

The Franklin Institute 14
Katharine R. Weidman, Arts '48

Prominent Engineers 16

News of the College 18

Techni-Briefs 20

Alumni News 19

President's Message 24

Stress and Strain 44

Cover: Materials and Metallurgy Laboratory to be constructed soon.

Frontis: Experimenters leaving high-altitude chamber at Buffalo Aeronautical Lab.

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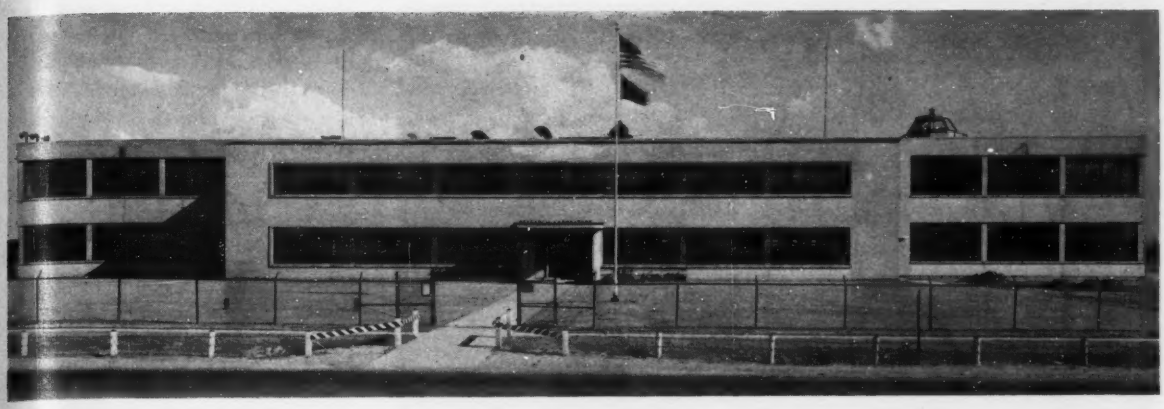


Aeronautical Laboratory

Engineering at Cornell (13)

By DR. C. C. FURNAS, Director

ONE of the really significant events in the history of advanced engineering education transpired on December 21, 1945, when the Curtiss-Wright Corporation made a gift of its Research Laboratory, located at Buffalo, New York, to Cornell University. In addition, six of the other major aircraft companies of the east coast—Republic Aviation Corporation, Grumman Aircraft Engineering Company, United Aviation Corporation, Bell Aircraft Corporation, Fairchild Aircraft, and the Aviation Corporation—made contributions to a substantial working capital fund to assure the continued successful operation of the Laboratory under Cornell.

Research Foundation

This institution, now known as the Cornell Aeronautical Laboratory, and operated under the Cornell Research Foundation, will serve as a meeting ground where education and industry get together and work for the solution of the problems of their future. Universities have two prime objectives—contributions to knowledge and the training of men. At first glance it might appear that industry's only objective is production, but a brief analysis inevitably shows that an industry that hopes to be permanent must also contribute to knowledge and must train men. Thus there is common ground where the two groups, education and industry, can very advantageously merge their activities, not only for the strengthening of the aircraft industry, but in the interest of national defense and of general welfare.

There is a tendency in industry to accuse academic institutions of being too academic ("impractical" is usually the label applied) and universities have a habit of accusing industry of being narrow-minded and short-sighted. Undoubtedly the honors are about even, for there is some truth in each contention. The Cornell Aeronautical Laboratory offers an ideal ground for realistically reconciling the two points of view. Graduate students in pursuing part of their career at that location will be brought in close contact with the research problems, elaborate equipment and advanced methods which are being applied to the problems of future aircraft. This will be the most realistic of training for future top-flight aeronautical engineers. The graduate students in turn, through their research work, will contribute very significantly to the fund of knowledge that will eventually make itself evident in the art and science of using the atmosphere as a medium of transport.

At the present time the staff of the Laboratory is engaged in research and development work on several Government projects and for aircraft companies. The projects embrace much of the most advanced work in aerodynamics, the dynamics of structures, instrument development, utilization of new materials and the design and development of new aircraft devices. It is anticipated that in the future this research program may be augmented by the still more basic research work of students of the Cornell Graduate School of Aeronautics. It is further anticipated that advanced courses of instruction will be provided for the graduate students while they are in residence at the Laboratory; the instructional staff being picked from both the campus at Ithaca and the Laboratory at Buffalo.

Laboratory Organization

About 575 employees are presently working at the Laboratory, about half of them being technical men: engineers, chemists, physicists, mathematicians. There are five

The static test area used test structural parts.

major research departments: Aerodynamics, Structures, Flight Research, Physics and Materials. In order properly to handle the development phases of a problem after it has progressed beyond the research stage a Development Division has been formed in the Laboratory, with three major departments parallel to the research departments: Armament, Development Engineering, and Manufacturing. This latter department is equipped and staffed to carry on "pilot-scale" manufacturing of items which evolve from the research program.

The Laboratory is also self-contained with respect to organizational services such as accounting, contracts, personnel work, maintenance, purchasing and material control.

Research Laboratory

The main Laboratory building, which was erected in 1942-1943, is a two-story brick structure divided into four main areas consisting of the Laboratory proper, the office section, power area and wind tunnel housing. It has a total floor space of some 94,000 square feet. The activities of the Aerodynamics, Structures, Materials and about half of the Physics Departments are carried on at this location.

The Aerodynamics department performs basic research in the fields of aerodynamics, thermodynamics, flight mechanics, and applies the results of these studies to the design of supersonic airfoils and bodies, high speed aircraft and missiles, jet power plants and other developments. This work is both theoretical and experimental.

The major piece of experimental equipment in the Laboratory is an all-steel wind tunnel which cost some $2,500,000, and has a working section of 8½ x 12 feet. At its maximum section, the diameter of the shell is 31 feet. It incorporates the most modern design features and is one of the outstanding tools of the aeronautical field in the study of the problems of high speed aircraft. The maximum velocity will be approximately 740 miles per hour. It is a closed circuit, variable-density tunnel with working pressures ranging from ¼ to 4 atmospheres, absolute. The two main-drive motors are rated at 10,500 h.p., with an allowable 15-minute overload up to 14,000 h.p. The models will be rigged outside the tunnel on carts which can readily be moved in and out of the working section, thus shortening the time for changing models from hours to a matter of minutes. Data from tunnel tests will be punched on cards and reduced in terms of any desired parameters in a matter of minutes by the use of International Business Machine equipment.

Other equipment includes a 3 inch x 16 inch transonic wind tunnel and several small supersonic wind tunnels. Airspeeds in the latter have been developed up to 1250 miles an hour.

Structural Department

The structures department of the Laboratory is concerned with research on aircraft structures in the broad and dynamic sense. Aircraft structures work, broadly defined, includes the study and functional testing of the electrical, hydraulic, pressurization and related equipment involved in the structure; as well as the usual fields of dynamic loads, structural test, flutter and aircraft structural design. The ac-

THE AUTHOR

Dr. Furnas received a B.S. degree from Purdue in 1922, and a Ph.D. from the Univ. of Michigan in 1926. For a number of years he conducted research work on metallurgy at the U. S. Bureau of Mines. In 1931 he became associate professor of chemical engineering at Yale. In the early war years he worked for the National Defense Research Committee, and in 1943 was appointed director of Curtiss-Wright research laboratory in Buffalo. He has conducted much research in the fields of process metallurgy and physical chemistry, and has specialized in phases of the research related to the aviation field.

Dr. Furnas

tivities include research on simplifying present aircraft structures, together with design and evaluation studies in the new fields of supersonic missiles and helicopters. Much of the work of this department carries over to flight studies which are carried on in collaboration with the Flight Research Department.

Hi-Altitude Chamber

In this department is located one of the largest and most modern altitude chambers. It is 34 feet long, inside, and 10 feet in diameter. Its Freon refrigeration system permits great latitude of operating conditions and versatility of control. It can "climb" to pressure altitudes of 80,000 feet, with corresponding temperatures, at any specified rate, automatically controlled. An extreme low temperature of —85°F. can be maintained. It is completely equipped with safety devices as well as means of operating equipment from outside for those cases where it is undesirable to have personnel inside the chamber during tests. Oxygen equipment is installed for 12 persons.

The static test area, which is also a part of this department, will accommodate airplanes up to 110-foot span and 80 foot length which can be hung from the heavy overhead beams and loaded by hydraulic jacks attached to multiple hold-down points in the floor. Tests of component parts may be performed on the cantilever backstop or in the various testing machines which include a Templin direct stress 50,000-pound, repeated load machine, three tensile and compression testing machines of various sizes and a small 4,000 pound Krause repeated load machine.

This department also has completely equipped hydraulic and electrical test laboratories.

Materials Department

The Materials Department is engaged in the research, development and evaluation of materials and their application to specific articles. This often calls for the initial design and production of the original item under consideration. There is also extensive collaboration with other departments on their material problems evolving from current laboratory projects.

This department consists of the following five sections, each with its separate laboratory: Metallurgy, Analytical Chemistry, Fuels, Wood and Plastics, and Metal Fabrication. The equipment available in the various sections include a 20 KW induction furnace, Lindberg controlled atmosphere furnace, various hardness testers, laboratory model metallograph, Beckman quartz spectrophotometer, gasoline and oil testing equipment, infra-red spectrometer, Bausch & Lomb large Littrow spectrograph with Dietert multi-source units and Leeds & Northrup microphotometer, Hayes X-ray diffraction unit, portable Westinghouse X-ray unit, AC and DC spot welder, and gas, heliarc and argon-arc welding facilities.

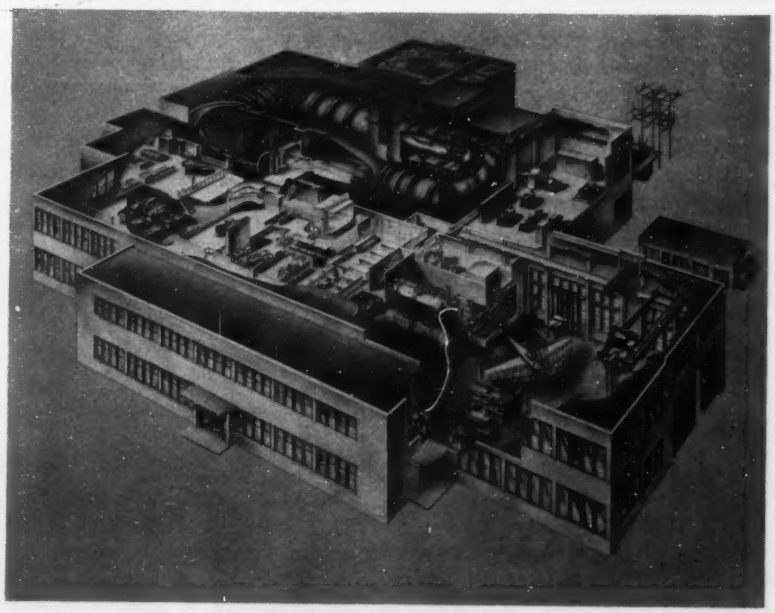
Outstanding among the developments of this department have been a new series of accelerators for room-temperature, no - pressure polymerization of plastics in both castings and laminates; and a new Multi-arc welding process which promises to widen the utility of welding very greatly, particularly for non-ferrous metals. Laminated, non-metallic helicopter blades, and laminated heater ducts have also been significant accomplishments of this group.

The Physics Department is composed of the following six sections: Physical Analysis, Optics, Electronics, Electromechanics, Instruments and Mechanical Design. These sections are equipped with facilities for the study and development in the fields of sound and vibration reduction in aircraft, high frequency communications, instrument dial illumination, instruments and electronic devices, including Radar. One of the outstanding developments in the department has been a telemetering system, designed and built for the Navy. This consists of air-borne equipment in a test airplane which transmits its information to a mobile receiving station on the ground, both in radio and television channels. Here the information is recorded by moving picture cameras and oscillographs. This system is particularly useful and adaptable to flight studies of pilotless aircraft and guided missiles. The laboratories of this department are completely equipped with the instruments and other facilities appropriate for the above types of work.

Model Shop

The Laboratory Model Shop has as its prime function the production of wind tunnel models. It also makes the first working proto-types of the various items arising from research activities. It has produced display models of many types and sizes, flight test instruments and

(*Continued on page* 40)



Cutaway section of the lab.

THE ENGINEER'S ROLE IN RAILROADS

By A. H. AYERS, M.E. '20 and A. D. PETERS

THE problems of a graduating engineer today are vastly more complicated than they were 45 years ago. This is true because our method of living is vastly more complicated.

Industry itself is much more complicated and more widely distributed, and there are many more so-called "basic industries".

These things provide greater opportunity, but they also make it more difficult for th eengineer to choose, unless he has a well developed leaning toward some particular line of work in which happy event the thing for him to do is to tighten up his belt and go after it. If he does that he is pretty sure to succeed.

"Success" in itself is an uncertain term. To some it may mean a constant struggle from one thing to another in an effort to grasp each opportunity for higher compensation or greater authority, or influence, even though it may mean transferring from one industry to another not once, but several times.

To others, success may mean a constant progress, not necessarily too rapid, involving reasonable stability of employment ultimately leading to a position of responsibility, security and contentment.

Often times, but of course not always, the total earning power of the latter type of position over a period of years is greater than some other lines of endeavor which, at the outset, may have appeared more attractive.

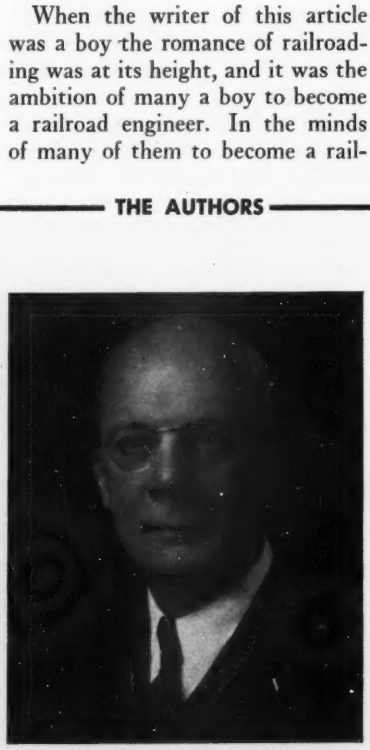
When the writer of this article was a boy the romance of railroading was at its height, and it was the ambition of many a boy to become a railroad engineer. In the minds of many of them to become a railroad engineer did not mean a technical engineer, but meant the man who drove the "monster locomotive". In those days there were very few technical engineers in the railroad business, except in the Engineering Department where Civil Engineers were needed on tracks, bridges, buildings and other structures.

At that time some of the more progressive railroads had established so-called "Special Apprenticeship" courses in the Mechanical Departments, recognizing the need for Mechanical Engineers in the development of railroad locomotives and cars. I believe the Pennsylvania Railroad was one of the pioneers in the establishment of this course.

As the steam locomotive developed in size and hauling capacity its cost of operation and dependability

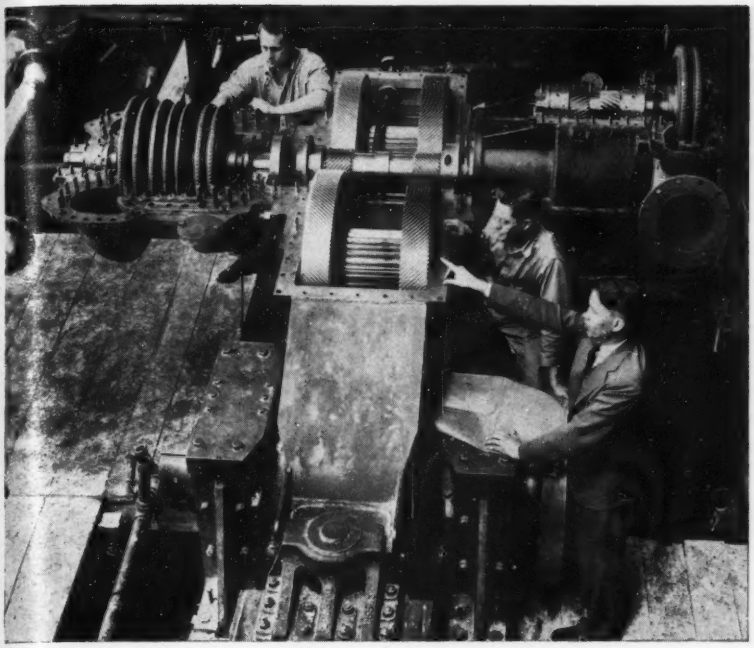
THE AUTHORS

Mr. Ayers was born October 26, 1878 in Toledo, Ohio. He had his preliminary education in the Toledo public schools and Cascadilla School of Ithaca, N. Y. He graduated from Cornell in 1900 with a ME in EE. He became a member of Sigma Xi, and Phi Kappa Psi. After graduation Mr. Ayers became a special apprentice on the Lake Shore and Michigan Southern Railway and later held other positions there. He then became the principal assistant in the office of Chief Mechanical Engineer for the New York Central Railroad in New York City in 1916. He has been General Manager for the Nickel Plate since 1927. In 1931 he became Chairman of the Mechanical Division of the Asseciation of American Railroads.



Mr. A. H. Ayers

Mr. A. D. Peters was born in Springport, Michigan, on November 19, 1879. He graduated from Springport High School in 1896 and went on to graduate from Michigan State College in 1905 with a B.S. degree in C.E. He entered the railroad service in the Engineering Department of the Lake Shore and Michigan Southern Railway at Cleveland, Ohio, in February 1906. He transferred to the Nickel Plate Railroad in July 1911. Mr. Peters served in various positions in the Operating Department, including Special Engineer, Division Superintendent and General Superintendent before he was appointed to his present position of Assistant General Manager in May, 1944.



—*Courtesy Westinghouse*

Testing the "driving power" for the new geared turbine locomtive.

of service became matters of increasing consequence, and the advantages that might result from greater attention to scientific engineering became more and more apparent not only to the builders, but to the users of these machines.

As the size, capacity, cost and diversity of design on freight cars increased, the general need for scientific engineering became evident.

The operation of power-drawn vehicles with metal wheels on steel rails has developed a character of engineering different from any other type of transportation and has established a field of engineering which is peculiarly its own.

The fact that the fundamentals of present day railroad equipment are much the same as they were years ago may give rise to the thought that railroading does not offer much field to the engineer. Let me call to your attention that the fundamentals of passenger automobiles, trucks, airplanes, machine tools, ships, and even houses and office buildings, have not changed materially.

There is the details of construction, development of materials, and innumerable special appliances that have caused the present day advancements in engineering, and this is just as true of railroads as it is of other industries.

The ability of railroad locomotives and cars, as well as track and bridges, to stand up and render outstanding performance under the grueling service to which they have been subjected during the past few years can be attributed in great part to the scientific engineering embodied in their design and construction.

This does not lessen the credit due to the men who maintained and operated this equipment during periods of extreme difficulty and who succeeded where less stout-hearted men might have failed, but it does mean that if the equipment had not been much better designed than it was 40 years ago, the task of these men would have been hopeless.

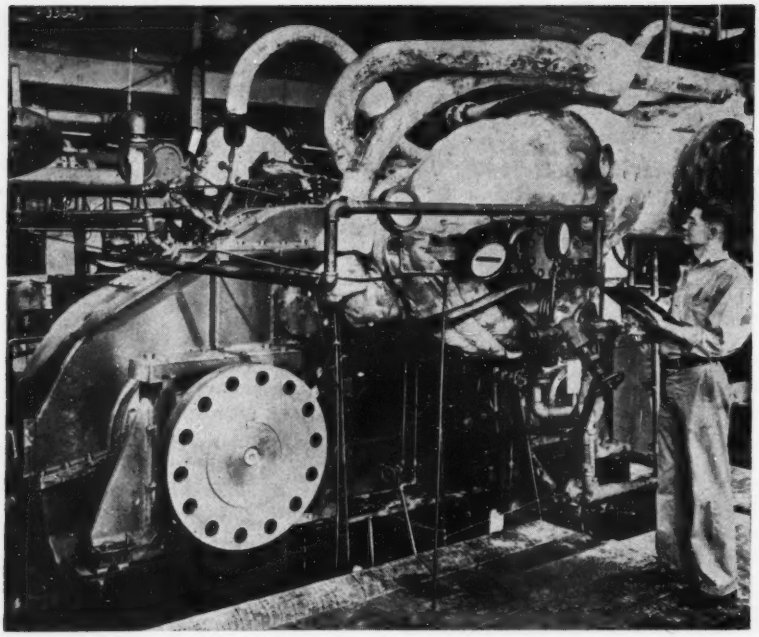
In common with other large industrial organizations, the business of a railroad is to produce efficiently and effectively what the consumer wants.

The product of some industrial organizations is automobiles, others rails, and so on; the product of a raliroad is transportation.

All large industrial organizations have some of the aspects of a military organization, that is, in order to produce the desired result the efforts of a number of different groups of men have to come to a focus at the right time and place. In some departments of a large organization of that kind detailed technical knowledge of different

Service cars test defective rails by the application of modern physics and are run by trained technicians.

—*Courtesy Sperry*



Checking steam conditions during one of the many trial runs on elements of the power unit during manufacture. *—Courtesy Westinghouse*

kinds of engineering is essential, but in the major part of the activity a thorough knowledge of the business, born of experience and coupled with good judgment, quick perception, initiative, stamina, a good understanding of men, resourcefulness, self-reliance, and courage are all essential.

College Only Helpful

Obviously, a man does not have to have an engineering training to possess these virtues and a great many men who have never been to college have been outstanding successes.

On the other hand, an engineering education not only trains a man in the specific subjects which he studies but also, particularly in an institution like Cornell, he does get intensive training which should develop his ability to think clearly, to analyze and to reason and to work out the correct solutions for many problems much better than one who has not had that training.

Speaking for the business with which I am most familiar, having been engaged in it continuously for over 45 years, a young engineer entering the railroad business at the bottom because he likes it and means to stay in it, and who has reasonably good physique, natural intelligence and ordinarily good personality, should have great possibility for success, providing also that he has the ability to understand and to get along with his fellow workmen, to take hard knocks, to put in long hours when needed, and to work sometimes under very adverse conditions, as a great deal of his work in the early days will be out of doors. A young man entering the railroad business comes immediately into competition with other young men who have had four years of practical training in the railroad business while he has been accumulating his engineering training and, to start out, they have that much advantage over him as far as usefulness to the railroad is concerned.

But a man with equal natural ability plus an engineering training should be able, in a reasonable time, to accumulate the necessary and practical experience and thereafter reach positions of greater responsibility and higher rank than one who is not so fortunately equipped.

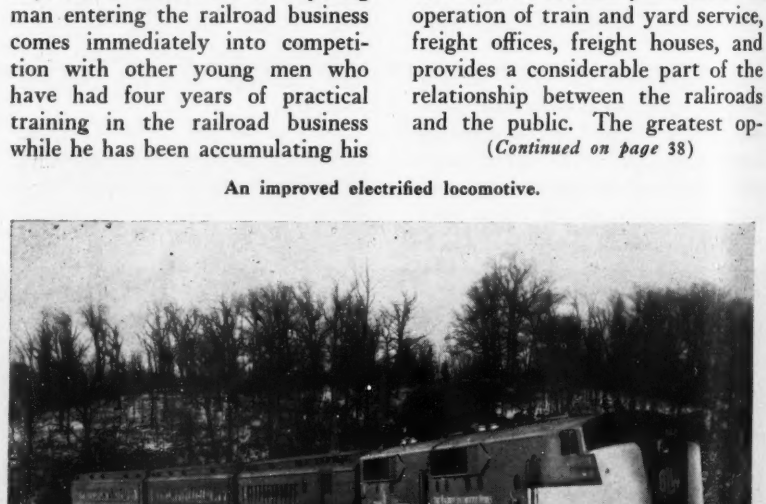
There are three departments in which the training of an engineering graduate is of greatest advantage to him. There is the Engineering Department, which is responsible for track, bridges, buildings and other structures; the Mechanical Department, which is ordinarily responsible for the design, construction and maintenance of locomotives and cars; and the Transportation Department, which has charge of train and yard service, freight house and station operation.

In the Engineering and Mechanical Departments the engineer has more opportunity for direct application of the technical details of his engineering training, and the results of this scientific engineering developments are very evident.

The Transportation Department of a railroad ordinarily includes the operation of train and yard service, freight offices, freight houses, and provides a considerable part of the relationship between the raliroads and the public. The greatest op-

(*Continued on page* 38)

An improved electrified locomotive.



THE ENGINEER AND ORGANIZED LABOR

By HUGH L. MYERS, ChemE '48

Editor's Note

Mr. Meyers, formerly an undergraduate student, now on leave with the armed forces, gives his personal views on one of the important problems before engineers of today — his relations with organized labor. Because of the constantly increasing cost of living, the salaried employees in the technical and scientific fields have been forced toward organization. Noted recently is the formation of the Technical Division of the CIO — an attempt by a national labor organization to satisfy the needs of technical and scientific employees for a separate bargaining unit. We believe that many engineers graduating from universities today are, to a large measure, unprepared to cope with this problem. By publishing this article, The Cornell Engineer hopes to stimulate thought on this subject and would welcome letters-to-the-editor commenting on this problem.

THE majority of the laborers on a huge construction project in the southern part of the United States are union men. In some departments, employment is on the closed shop basis. Many Civil Engineers are employed on the project, and each has a staff of semi-skilled technical assistants, such as rodmen and transit men. Some time ago, these assistants were ununionized. They saw the advantages of the union. There is strength in numbers. They understood why men could demand, and get, so much more. They are now union men, and when they formed their union local, they tried to include the professional engineers for whom they worked. The engineers, faced with a demand of the entire union organization for a closed shop, joined the technicians union, and thus associated themselves with sub-professional workers. They were outnumbered five to one, and could secure few of their demands. From the friction which resulted, there developed a great feeling of discontent and antagonism between the engineers and their assistants. This is symbolic of a number of similar cases which have risen to confront the modern engineer.

Gains In Organization

Since the First World War, organized labor, stimulated by pro-labor legislation, has made tremendous gains in organizing workers, improving working conditions, and, in general, raising the worker's standard of living. Although in some cases the methods have been somewhat dubious, there is no doubt that organized labor has contributed much to the welfare of the nation.

During World War I, the War Labor Board maintained that employees had a right to bargain collectively. The Railroad Labor Act, passed in 1926, gave workers in this particular field the right to organize without interference. The National Industrial Recovery Act, which was later declared unconstitutional, extended these rights to all men. In order to retain some of the principles of the nullified N.I.R.A., Congress passed the Wagner Act (the National Labor Relations Act). The Fair Labor Standards (Wage-Hour Law) again specified union rights, in addition to setting minimum wages and maximum hours.

In the meantime, grand scale employment of (employees) had taken place to such an extent that pressure of union groups was forcing (professional engineers) to join the ranks of organized labor and to delegate their collective bargaining rights to labor. During the five year period, 1935 to 1940, the National Labor Relations Board was dominated by a group of pro-labor lawyers who believed that their purpose was to unionize American Industry, rather than to alleviate trying conditions brought about by friction between labor and management. Thus, engineers employed in large numbers found themselves in the clutches of modern organized labor with but one course to follow; that course was to "join up." In joining unions such as those affiliated with the CIO and A. F. of L., engineers not only become minority members of powerful public agencies, but also suffer degradation of their professional standing. Being but a small group compared to the many laborers and semi-professional workers, engineers cannot obtain any real benefit in transferring their rights to these groups, since they are outnumbered on most issues. By affiliation in such high pressure organizations with sub-professional employees, engineers suffer a definite loss of high professional standing.

Exemption From Union Action

In nearly all cases in which professional employees have petitioned the federal arbitration unit then existing for the right to be exempt

(Continued on page 32)

THE FRANKLIN INSTITUTE

By KATHERINE R. WEIDMAN, Arts '48

All cuts courtesy Franklin Institute

THE Museum of the Franklin Institute on the Parkway in Philadelphia, differing from most other museums, encourages its many visitors to operate the exhibits. One of the most popular permanent features is the hundred-ten-foot-long locomotive engine and coal car, so constructed that even a child can operate it from the cab. By merely pushing a button in the Hall of Chemistry, a visitor can observe a chemical reaction such as a neutralization in the presence of indicators. In the Hall of Physics, simple periodic motion may be seen by watching the figures traced out on a table by grains of sand falling from the swinging sand pendulum.

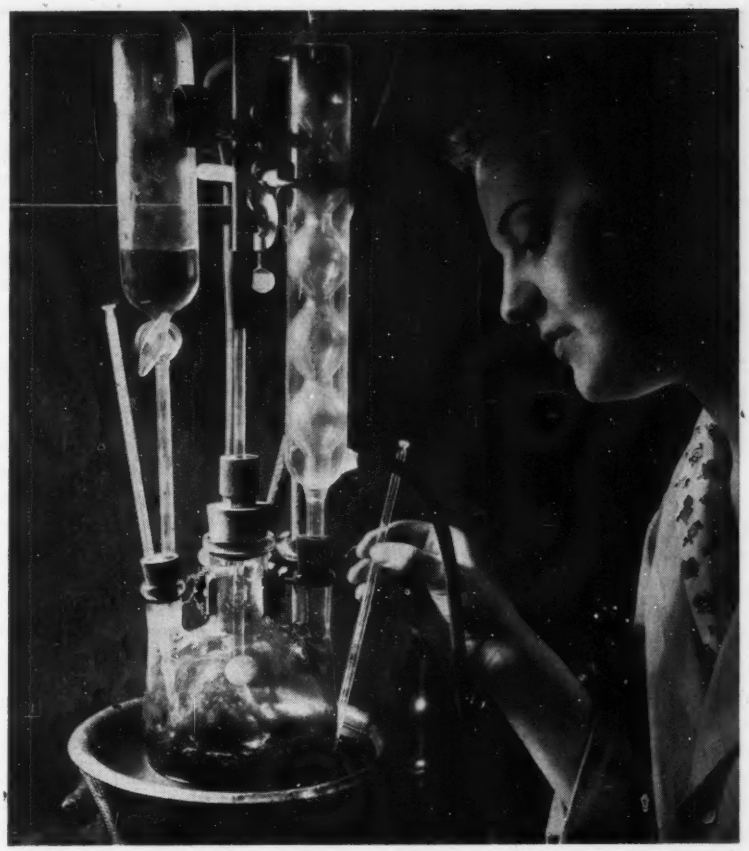
Aims of Institute

Founded in 1824 by Samuel V. Merrick, Engineer, and William H. Keating, the Franklin Institute has always been primarily devoted to furthering interest in and greater understanding of science, particularly the applications of scientific principles to industry. Under the auspices of the Franklin Institute, the first exhibition of American manufactured goods was held in 1824. There were three hundred exhibitors including the producers of blister steel, bar iron, and textiles. Premiums and medals were awarded to outstanding industrial developments, which greatly helped to advance American industry. Similar exhibitions were held for more than twenty years, and culminated in the Philadelphia Centennial of 1876. This great Centennial, the first international exhibition in North America, was authorized by Congress, which acted on a suggestion made to it by three members of the Institute. At the exhibition the Bell Telephone was first publicly displayed. Eight years later, without Federal or State aid, the Institute held the first Electrical Exhibition in the United States. Three results of this were the creation of the U. S. Electrical Commission by Act of Congress, the carrying out of the most complete series of tests on electrical appliances up to that time by foreign and American scientists, and the organization of the American Institute of Electrical Engineers. In 1899 a National Export Exposition was held.

The Gunairstructor which trained pilots to bring down enemy aircraft.

In addition to its exhibitions of manufactured products, the Institute aided industry and, more im-

portant, human welfare. Some of its first members exposed mechanical fakes such as Reidheifer's "Perpetual Motion Machine" run by concealed human power, and the Keely motor, which endeavored, through the use of intricate machinery, to transmit more power to a volume of water than was inherent in itself. The *Journal of the Franklin Institute*, the oldest technical magazine in the United States, was first printed in 1828. In its early years abstracts of specifications and claims were published in the magazine; because the U. S. Patent Office did not file these before 1843, the *Journal* is the only source available for such information between 1828 and 1843. In 1864, through agitating, the Institute secured the standardization of screw-threads and nuts. From 1886 until 1891 it served as State Weather Bureau. At the request of the Board of Health of Philadelphia in 1897, members held a discussion on proper construction of furnaces and better methods of firing in order that the problem of a smoke-filled city might be somewhat alleviated. When high-pressure steam boilers were first used, serious accidents due to exploding boilers were almost everyday occurrences. Backed by Federal funds, the Franklin Institute developed the first machine for testing boiler-plate. Similar inventions were developed in connection with water power. Specific investigations by Institute committees led to fire precautions in public buildings such as the use of an asbestos curtain on a stage, fixed chairs in the body of an auditorium or hall, adequate aisle space, and doors that open out.



An experiment in the development of textile processing oils, shown in the exhibit by E. F. Houghton & Co.

Instruction Groups

The first Institute instruction groups were held in mechanical drawing; later classes in machine designing, naval architecture, and mathematics were added. Inventors took models to the Institute and these were used in the drawing classes. The models grew in number to form the nucleus of today's museum, which opened its doors on January 1, 1934.

The Museum of the Franklin Institute is divided into various sections, the principal departments being astronomy and observation, photography, physics, marine transportation, electrical communications, chemistry, land transportation, aviation, paper-making, printing, prime movers, and machines. Each section has a permanent exhibit, serving as a core, to which displays portraying new developments are added from time to time. The permanent collections, for example printing, paper-making, and electricity, are centered primarily on Benjamin Franklin's activities and their modern applications. Two of the greatest treasures of the Museum are the original glass tube and static electric machine which Franklin used for his first electrical experiments.

Other Exhibits

However, not all the exhibits of the Institute are confined to the building on the Parkway. A few years ago three shows, one devoted to dyes, one to perfumes, and one to liquid air traveled about the country; later these were combined to make one complete exhibit. Demonstration equipment to use in teaching physics, and small portable telescopes are lent to parochial and public schools. The Institute's exhibit, "American Women in War Work," opened in Moscow, USSR on March 8, 1945. This was prepared by the Institute in cooperation with the Women's program of the War Manpower Commission, Women's Bureau of the U. S. Department of Labor, and Office of War Information.

Planetarium

On November 6, 1933, the Fels Planetarium which is housed in the Museum, was opened to the public. In the center of the hemispherical room stands the Planetarium projector which faithfully reproduces the motions of the planets. To make one feel that he is actually standing outside on a clear night, the skyline of Philadelphia is silhouetted around the walls, and one may easily pick out such landmarks as the statue of

(*Continued on page* 28)

PROMINENT

"Inky"

Inez Leeds, ChemE

THERE is a story about the freshman M.E. who made a play for the coed sitting next to him in the Straight. His approach began with an interpretation of present trends in engineering and a display of his vast knowledge of engineering. Her only remark was, "My, you must be so very smart, Home Ec seems so terrifying!" Imagine his surprise on attending his first Chem lab to find that this same girl was actually his instructress. To those of us who have spent time at Cornell she is "Inky," the first woman in the history of Cornell to go completely through the ten term ChemE course.

This February Inky received the BChemE degree and went to work for the Hercules Powder Corporation in Wilmington, Delaware. She entered the Chem E school in September, 1942, and has completed a five-year course in three and one-half. The most amazing of her achievements is that she still looks like a very attractive freshman.

Inez entered Cornell from Julia Richman High School in New York. Here she was an editor of her school magazine, and Valedictorian of a class of over 1000 girls (we had to threaten to break her slide-rule before she confessed to the latter achievement). Her early ambitions developed from being a pianist to a writer; an impulse in her senior year directed her towards her chosen field, and she has done a remarkable job in adhering to it.

Inez has put herself completely through her ten terms. She has held many scholarships including a woman's club award, the prized LeFevre, McGraw, Dormitory, New York State Regents, and New York State Tuition Scholarship.

She has been a teaching assistant in the Chemistry Department at Cornell for five terms. She began assisting in Organic Chemistry course for V-12 premedical students when she was only eighteen. She claims that that first day conditioned her to any situation she would ever encounter. "I made the mistake of looking hopelessly frightened; worse yet, I neglected to check the times each sailor got my signature for a liter of ethyl alcohol. . . ."

Inez is Secretary-Treasurer of the Student Council of the College

(*Continued on page* 26)

Anthony S. Rugare, ME

MOST engineers would be inclined to say that philosophy and a slide rule are incompatible. There is at least one within the halls of Sibley who is not in complete agreement with this view, Tony Rugare. His slide rule and his philosophy book seem to be in complete harmony.

Before coming to Cornell, our philosopher roamed the halls of Thomas R. Proctor High School in Utica, New York, while pursuing a preparatory engineering course. He did not decide upon engineering in any spectacular way, but merely felt drawn to all the glamor and opportunity for creative work which he claims engineering has. Next to being an engineer he would have liked to be a journalist. While in high school Tony became actively interested in journalism and whenever he was not involved in a solid geometry theorem the school's press club would occupy his attention. After accumulating an average which netted him the valedictorianship and a couple of scholarships, the lad from Utica headed for Ithaca and Cornell where he registered as an M.E.

It was only natural that Tony should aspire to become a board member of the CORNELL ENGINEER. One of his greatest thrills in college was to see an article written by him in print. At present he is Illustrations Editor of the ENGINEER and makes no apologies for his accompanying picture.

Besides devoting time to the CORNELL ENGINEER, Tony has also found time to serve as consul of his fraternity, Alpha Phi Delta, and as Recording Secretary of Tau Beta Pi. He is also a member of the Newman Club, and as a reward for his interest in engineering materials he recently received student membership in the American Society for Testing Materials.

Tony's interest in materials and metallurgy is further evidenced by his position as an Assistant in the Engineering Materials Department. Most afternoons find him at work in the X-ray lab radiographing steel specimens. After he finishes framing his B.M.E. degree this February, Tony hopes to either enter graduate school or to secure work in the metallurgical field.

But what of Tony and his philosophy? Well, as Tony puts it, after seven terms of straight engineering he found that he was thinking less of the abstract and what the world was made of, and that, he felt, tended to make one too dull and materialistic. According to him the outlet which philosophy provides for troublesome thoughts and emotions is good for any one—even an engineer.

Tony

ENGINEERS

Alexander Brady, ME

AL, better known as "Lex" to all his friends, was born in Nanking, China, some 20 years ago while his father was a professor at the University of Nanking. His family returned to the United States in 1927 while the soldiers' revolution was underway in China. After a year in California, they settled in Royal Oak, Michigan, where his home is now. He attended Royal Oak High School and was elected to the National Honor Society. He received the McMullen regional scholarship upon graduation from high school and entered Cornell in July, 1943, as a civilian. Al joined the Navy College Training Program in November, 1943. During his Sophomore year Al joined Sigma Alpha Epsilon fraternity, and it was also during his sophomore year that he went out for crew. He won his letter as coxswain on the varsity crew when he was a junior and is a member of the Crew Club. It was also during his Junior year that Al was elected to Atmos, honorary society in mechanical engineering. Al's first four terms in V-12 were spent in Dorm 11, the Lambda Chi house. Dorm 16 was his next residence but after that was condemned, he was forced to move again—this time to Dorm 6. After good old Dorm 6 was returned to the Dekes, Al's next quarters were Dorm 18 and North Baker East, home of the famous "301" Club. So, all in all, Al has really been around since he first set foot on the campus.

Al

As a member of Pi Beta Tau, honorary engineering social society, Al has proven his ability to hold the old brew. Speaking of brew, just mention the word and his mouth waters. An ardent lover of "small parties," Al has hit the Binghamton route many a week-end in the "Beetle"—the Beetle being that model A on the campus that has had as many owners as Carter has liver pills.

Last term Al was elected president of the ASME branch here at Cornell. He was also elected president of Atmos Society. At present he holds a position on the Senior Week Committee as Co-chairman of the Senior Ball. His favorite pastime does not include studying, at least that's what he says. He can often be found working crossword puzzles over a cup of "Joe" in the Straight. Either a crossword puzzle or the sack could be considered his favorite pastime, although a certain

(*Continued on page* 26)

L. Whitley Simmons, EE

LAWRANCE WHITLEY SIMMONS came to Cornell as a budding freshman with that much mentioned first group of V-12's back in July 1943. Whit came up as a civilian, but after recovering from the effects of the Black Diamond overnight he reported to Barton and was in the Navy. After figuring out a system whereby he didn't spend all his time washing white uniforms and attending musters, he set out to "get through" college.

"Perhaps the best thing I did was to go out for the CORNELL ENGINEER. There have been many times, though, when I have probably thought differently." Explaining this he says that being a compet wasn't always very exciting, and then when you're editor sometimes things have the facility of going wrong all at the same time. Whit seems to have taken the fun, headaches, and work in stride, though.

Whit came out for the ENGINEER in the fall of 1944. After serving on the board he was elected Assistant Editor-in-Chief in the spring, but in the absence of the managing editor he took over that job until becoming Editor-in-Chief this term. He says that it is unfortunate that the staff changes so often now, but he hopes that things will settle down when the university gets back to the normal two terms a year basis. He feels that he could have done a better job had he been with the magazine and held his present position longer. "Being with the ENGINEER has broadened my experience considerably, and I believe that I have learned much about dealing with people."

Whit

Whit good naturedly takes some kidding on the endless possible variations of his nickname—Whitless, Halfwit, and Dimwit to name a few. Then of course "Baldy" sometimes slips in there. "Well I always did have a high hairline," explains Whit. However, he may admit that his hair is thinning out a "bit," but then, "baldness is a sign of intelligence anyway." "Yes maybe I ought to catch a woman before it is all gone, but then I have more than my father did at my age,—hair I mean."

"Academic record? . . . Yes, I made the dean's list, but only for the first three terms before things got tough." He thinks that good grades are all right, but that beyond a certain acceptable minimum they shouldn't be given too much weight. He feels that during the college period one should not only

(*Continued on page* 26)

NEWS OF THE COLLEGE

New Provost

ARTHUR S. ADAMS has returned to Ithaca recently as provost-elect of Cornell.

Before entering the Navy in 1942 to organize and direct the V-12 program throughout the U. S., Captain Adams was assistant dean of the College of Engineering at Cornell and directed the Engineering, Science, Management War Training program as well as the Diesel engineering course for Naval officers.

He was named University provost in April, 1944, while serving as officer-in-charge of the administrative section of the training division, Bureau of Naval Personnel, in Washington.

At the conclusion of his duties with the Navy recently, Captain Adams was awarded the Legion of Merit for distinguished service in administering the nation-wide V-12 training program.

Before his first appointment to Cornell in 1940 as assistant to the dean of the College of Engineering, he was professor of mechanics and assistant to the president of the Colorado School of Mines. A graduate of the U. S. Naval Academy and of the U. S. Submarine School in 1918, he holds the M.A. degree in physics from the University of Colorado, and the Sc.D. from the Colorado School of Mines.

Counselor of Men

FRANK C. BALDWIN, Cornell graduate in 1923, has been appointed counselor of men students at Cornell University, effective immediately. He has been serving as acting counselor of men students since last September.

Formerly the headmaster of Harrisburg Academy and academic dean at Penn Hall Junior College, Baldwin served in the Army Air Corps from June, 1942, to September, 1945, as a captain and later as a major. Stationed at Dale Mabry Field, Tallahassee, Fla., he was in charge of the ground training program for thousands of fighter pilots and served as executive officer of the Third Fighter Command Ground Training Unit.

As an undergraduate at Cornell he rowed varsity crew, and was elected to Sphinx Head and Phi Kappa Psi. From 1926 to 1931 he was an instructor at Blair Academy; from 1931 to 1935 an instructor at Pingry School; and during the following year took graduate work at Columbia University before his appointment at Penn Hall.

Assistant Vet Director

THE appointment of Lieut. Comdr. Donald H. Moyer, former counselor of men students at Cornell, as assistant director of veterans education at the University was announced recently by President Day.

Commander Moyer will begin his new duties immediately at the Office of Veterans Education, 13 East Avenue, of which Prof. L. C. Petry is director.

Moyer returns to Cornell after 2½ years in the USNR during which time he was commanding officer of the Navy V-12 unit at St. Lawrence University. He is on terminal leave with the navy until January 19. He was counselor of men students from July 1, 1941, until May, 1943, when he received a commission as lieutenant in the USNR.

A graduate of Harvard in 1927, Commander Moyer received the M.A. in psychology at the University of Michigan in 1928. After serving two years as research assistant to a committee on vocational counsel and placement at Michigan, he was assistant director of the Harvard Alumni Placement Service until 1941. He has written a number of articles on vocational selection and occupations, and co-authored a book entitled "Vocational Information: A Bibliography for College and High School Studies."

THE following were elected to Tau Beta Pi, national engineering honor society, this term: L. R. Anderson, E. D. Barkhuff, T. M. Berry, A. Czerkes, C. R. Fisher, J. Fontanella, R. C. Hammond, A. B. Levine, R. D. Loucks, D. W. Milburn, H. G. Petrey, E. J. Raser, F. E. Rom, and E. Wallace.

Initiations were held in Sibley Library on February 15, followed by a banquet at the Alhambra. The guest speaker was Prof. Loren C. Petry, Director of Veterans Education.

A MEETING of the Student Section of the A.I.E.E. was held in Franklin Hall on Friday night, February 8. Dr. Feynman presented an interesting lecture on atomic energy. This discussion was followed by the election of officers for the next term. The new officers are Chairman, Bill Wilder; Vice-Chairman, "Andy" Anderson; Secretary, Tom Talpey; Treasurer, Ed Raser.

ETA KAPPA NU, honorary electrical engineering society recently elected the following men to membership: L. R. Anderson, E. W. Atherton, J. O. Jensen, R. W. Persons, R. B. Seidel, H. R. Snow, E. O. Snyder, G. R. Spencer, D. A. Sweetland, J. L. Wheeler.

The initiation and banquet in honor of the newly-elected members was held on February 5, when Dr. Arthur F. Adams, University Provost, addressed the group.

THE Delta Club, EE social society, has been hampered in its activities for the fall term by the lack of an appropriate place for its initiations and parties.

For many years, the club has served as an informal meeting of faculty members and students outside of the classroom. In previous meetings plans have been discussed for a party to acquaint new EE's on the campus with the social life of the club. A basketball team was formed to play the other engineering societies. Any one interested in a game can get information by contacting Bart Snow, secretary.

During the Spring and Summer terms the following members were initiated: Professors Cotner and Cottrell, Andy Anderson, Studs Kaemmerer, Cletus Lauth, Pete Peterson, Bill Shanley, Chuck Riewe, and Bill Weigle.

ALUMNI NEWS

THE Philadelphia Chapter of the Cornell Society of Engineers held the fourth of a series of forum meetings on January 24 at the University Club in Philadelphia. The subject of the meeting was "Electronics and Television." Larry E. Gubb, M.E. '16, Chairman of the Board of Philco Corporation, was the main speaker. Mr. Gubb was President of the Cornell Alumni Association from 1942 to 1944, and is now a member of the Board of Trustees of the University. A large number turned out to hear the interesting discussion.

DR. GUSTAV EGLOFF, A.B. '12, an engineer for Universal Oil Products Co., Chicago, has arrived in China to head an oil mission for the Chinese government under the auspices of the National Resources Commission of China. Dr. Egloff, in collaboration with another Universal engineer, will make a preliminary study and recommend steps to be taken in order to carry out plans for establishment and development of a modern petroleum refining industry.

Dr. Egloff, who has been with Universal since 1917, has been awarded many honors from scientific and technical organizations, is president of the American Institute of Chemists, and a member of numerous scientific and technical bodies. He has had long and varied experience in petroleum research and practical refining.

The National Resources Commission of China, which secured the services of Dr. Egloff, has charge of promoting and developing key industries and administering other industrial enterprises. In accordance with presently contemplated operations, he will aid in the following phases of the development project: Improvement of operations of refineries now running; placing in operation refineries now operable; effecting repairs, replacements, and modifications required to place damaged refineries in service; coordinate expansion of refining facilities for present and future regional and national needs of China.

It is expected that Dr. Egloff will concentrate his efforts for some time on the Yumen field. Discovered in 1939 near the southern edge of the Gobi Desert, this field is eventually expected to be a large-scale producer.

LIEUTENANT WILLIAM T. FINE, M.E. '40, technical service officer at Ordnance Headquarters, Manila, was photographed on the terrace of the Commissioner's home in Manila with Japanese General Tomoyuki Yamashita during the closing session of the "Tiger's" trial in Manila.

Former captain of Cornell's boxing team and winner of the intercollegiate boxing championship in 1939, Lieutenant Fine wears the Asiatic-Pacific Theatre Ribbon and the Philippine Liberation Ribbon.

FREDERIC C. BURTON, B.C.E. '41, is a construction engineer and superintendent for Dravo Corporation. Burton is engaged on a project of digging coal from the Ohio River in the only underwater coal mine in the world.

JOHN W. MAGOUN, M.E. '12, who served during the war in an executive capacity at the Chester (Pa.) Tank Depot, Philadelphia Ordnance District, has received a War Department citation for his aid to the war effort as a civilian. The honor was in recognition of "outstanding contributions of improved methods and procedures which have proved to be of immeasurable value to the Chester Tank Depot."

MAJOR HENRY C. GIVEN, B.Chem. '24, returned from three and a half years in the Army Air Forces, has been appointed sales promotion manager of the Equitable Gas Co., Pittsburgh.

Until late in 1944 he was on the staff of the Army Basic Flying School at Ontario, Cal.; then was in the Air Technical Service Command on contract termination; last September, was detailed as executive officer of a Pacific island air base, returning to the States in late November.

Former president of the Cornell Club of Western Pennsylvania and with Equitable Gas since 1926, he was successively engineer of tests, heating sales engineer, supervisor of heating sales, supervisor of refrigeration and radio sales, and supervisor of trade development.

ROBERT D. KELLER, M.E. '30, who has been a member of the scientific bureau of Bausch & Lomb Optical Co. in Rochester since 1942, this past fall became representative in the Southwest on the complete ophthalmic line for the company.

H. ALFRED STALFORT, C.E. '34, project manager for the Consolidated Engineering Co., Baltimore, of which his father, John A. Stalfort, C.E. '10, is president, was recently elected president of the Building Congress & Exchange of Baltimore. This is a local association of the building industry and includes the contractors, architects, engineers, building supply dealers, and subcontractors.

WALTER L. HARDY, B.Chem. '37, Chem.E. '38, was released from the Army in October as a lieutenant colonel and is now associated with Protective Coatings Corp, Belleville, N. J., as general manager.

MAJOR EDMOND R. URQUHART, E.E. '39, has won the Bronze Star Medal for meritorious service in connection with military operations from January 20, 1944, to May 8, 1945, while serving with the artillery and fire control section, and as a chief of a weapons section, technical division, Headquarters Communications Zone, in the ETO.

He was cited for his "immediate contribution to the organization and functioning of antiaircraft maintenance in the United Kingdom and Continental Europe," and the manner in which he supervised the investigation and correction of all weapon deficiencies "as to result

(*Continued on page 30*)

Recent Developments In Engineering

Techni-Briefs

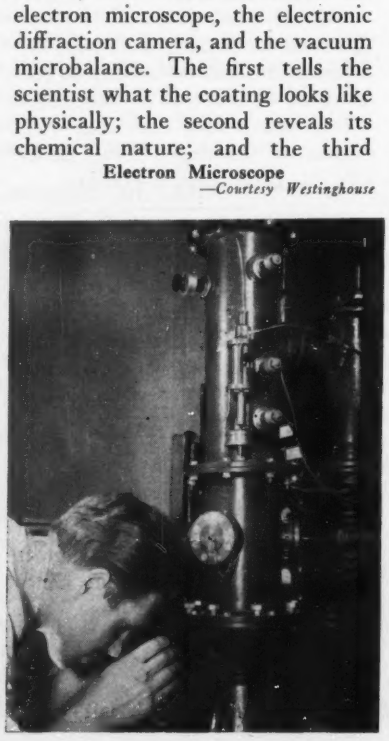
Electron Microscope

THE causes of rust and corrosion are hidden in a layer of atoms so minute that one hundred million of them stacked on top of one another would barely equal an inch. Yet Dr. Earl A. Gulbransen of the Westinghouse Research Laboratories has made thousands of photographs of such layers, weighed them accurately, and taken electron "portraits" that show their chemical nature.

The Westinghouse scientist is attacking one of the fundamental questions facing metallurgists, chemists, and other men of research: what actually happens in the invisible boundary zone that is formed when the metal comes into contact with air, or when any solid reacts with a gas. This study is aimed at providing ways to produce better tin plate, cheaper stainless steel, stronger gas-turbine blading, and longer-wearing bearings for engines.

To probe the atomic nature of the coatings or oxides that form on metals, three tools are used: the electron microscope, the electronic diffraction camera, and the vacuum microbalance. The first tells the scientist what the coating looks like physically; the second reveals its chemical nature; and the third measures the rate at which the coating grows.

Electron Microscope
—Courtesy Westinghouse



The electron microscope enables one to "see" the tiny film of atoms by magnifying it up to 50,000 times. This is done by means of a high-voltage beam of electrons that passes through the sample and is pulled outward by magnetic fields along the sides of the microscope. The magnified image, produced by two successive spreadings of the beam, is recorded on a strip of photographic film in the form of a shadowgraph.

In the diffraction camera an electron beam is again used, but this time it is fired at an angle to the sample so that it ricochets off and strikes against a strip of photographic film. The result is a pattern of black and white semi-circles that are formed by electrons bouncing off the different faces of the block-like molecules of the oxide coating. By measuring the distance between the rings, the scientist is able to identify the chemical nature of the oxide.

How quickly rust and tarnish are built up on a metal exposed to air is measured by the vacuum microbalance. This is a highly sensitive instrument constructed mainly of quartz and hair-like tungsten wire, and enclosed in a vacuum chamber. The sample to be weighed—a piece of steel for example—is hung on one end of the balance beam, while a counterweight is suspended from the other; small amounts of oxygen are then admitted into the chamber which form an oxide coating on the metal, making it gradually heavier. Movement of the balance beam is watched through a microscope, and the changes in weight are recorded every few minutes—usually in millionths of a gram.

By studying the atomic ingredients of rust, corrosion, and tarnish, it is hoped that a "recipe" for metals and alloys that will make them resistant to such attacks can be produced. Heretofore, the method of preparing such alloys has been a trial-and-error one, the constituents being mixed in a furnace and then tested under various conditions. This study aims at providing the metallurgical know-how for eliminating this step and making the production of alloys an exact science.

Electric Blacksmith

AN electrical "blacksmith," an instrument which automatically presets the thickness to which metals are rolled into shape on huge steel mills, has been developed by General Electric for obtaining greater production and accuracy in steel manufacture.

The instrument, which eliminates the human element when it comes to adjusting the mill for rolling metals at different thicknesses, has simplified the process to such an extent that a worker with little experience would be capable of performing the operation which formerly called for such workmen as Longfellow's "mighty Smith."

The press of a button will put the instrument, technically known as the automatic screw down control, to work in controlling the steel rolling machinery. The instrument has a range control for presetting the delivered thickness of metals from 12 inches down to less than a fraction of an inch.

Developed during the war and first used on a plate rolling mill, the instrument also is finding application in other mills.

Super-Giant

A NEW 1,000,000-pound "super giant" electric locomotive, 143 feet long, destined to be the most powerful continuously-rated electric locomotive in the United States, is to be built by the General Electric Company at its Erie, Pa. plant for delivery in 1946.

An order for four such new leaders-to-be of all electrics has been placed with General Electric by the Virginian Railway Company. To be used mainly for heavy coal-haulage operations over the Allegheny mountains, the four new kings of

the rail will handle freight on the Virginian's electrified territory between Roanoke, Va. and Mullens, W. Va.

The "super giant" will be the first of any kind of locomotive to carry weight of 1,000,000 pounds on drivers, the present heaviest weight on drivers being slightly more than 900,000 pounds, according to record.

What will establish the coming iron behemoth of the track as supreme among all electrics, however, will be its rating of 8,000 horsepower, 6,800 horsepower of which will be available continuously at the rails. Such a tremendous drive has an edge of 800 horsepower over the presently most powerful locomotive.

The "million pounder," with such horsepower, will have a starting tractive effort of 260,000 pounds, based on 26 per cent adhesion to rail, and will have a continuous tractive effort at 15.75 miles per hour of 162,000 pounds. The present most powerful electric has a starting tractive effort, based on 25 per cent adhesion to rail, of some 50,000 pounds less.

Such pulling power, applied to the Virginian line's electrified territory, will mean that the new G-E "super giant" will be able to pull 10,000-ton coal trains at moderate speeds on heavy grades, while with lighter freight behind it will be able to utilize speeds up to 50 miles per hour.

According to design, two 4,000-horsepower motor generator sets, mounted within the cab structure, will supply energy to a d-c traction motor, which will be geared to each of 16 driving axles under the two-cab unit.

The motor generator sets will work on an 11,000-volt, 25-cycle overhead contact system, with which the Virginian line is equipped. Stations generated by coal will send power through this system.

The "Million Pounder" —*Courtesy General Electric*

Infra-Red Spectroscope —*Courtesy Westinghouse*

Chemical Analyzer

WHAT are the raw materials that make up this piece of plastic? How much of each is present and in what proportion? What is the molecular pattern of this sample of oil? Are there any impurities and in what percentage?

Questions like these, of vital importance to the oil, chemical, and plastics industries, have always been difficut to answer. To analyze an oil sample by ordinary chemical methods, for example, may take a crew of six technicians eight hours. And the results are not always as accurate as desired.

Enter now the infrared spectroscope with its invisible beam of light that "fingerprints" each component of the material, and performs the job many times faster and more accurately than any previous method. A specially designed version of this most modern of spectroscopes has been developed by Dr. Donald K. Coles, young physicist at the Westinghouse Research Laboratories.

To analyze a material—either liquid, solid, or in solution—a sample is placed in a special holder and a beam of infra-red light which is produced by heating a silicon-carbide rod to an incandescent glow is directed through it. Highly-polished mirrors and special prisms guide the light along a thirty foot-long, zigzag path to highly sensitive receivers that convert the light into electrical current, amplify it, and record the information with an electronic pen on a chart outside the machine.

The infra-red spectroscope depends for its speed and accuracy of analysis on the fact that the molecules that make up all matter vibrate at certain characteristic frequencies—millions or even billions of times a second. The spectroscope quickly ferrets out this frequency by "tuning" the frequency of the infra-red beam to that of the material under study—just as you tune your radio set to the frequency of the station you want. When the two vibrations coincide the material absorbs the infra-red beam and this fact is recorded on the chart by a moving pen. This frequency is then compared with a standard previously determined, and thus the material is identified as accurately as fingerprints reveal human identity. Any impurities are instantly detected.

Not only will the infra-red spectroscope prove valuable in its practical applications to industrial processes, but as a pure research tool it should enable scientists to uncover hitherto unknown facts about molecular structures, and thus provide fundamental data of a kind that led to the development of the x-ray, radar, and atom-splitting.

WAR-FILE O

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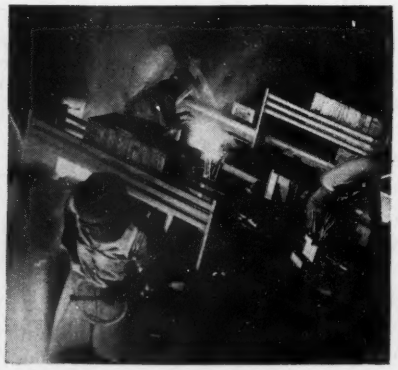
Official U. S. Navy Photo

1 Early in war, A-C's work with e tric power helped to solve ser war shortages. For instance, light metal industries faced problem: *How to boost outpu aluminum for fighting planes?*

5 To aid plants in figuring substation needs, A-C introduced a system of visual planning—*scale model layouts of power units and switchgear*—elim-inated hours of paper work, comple tables, drawings!



6 New alternating-current welder, de-veloped by A-C, gave shipbuilders and construction men important new production tool—used powe more efficiently without converting to direct current.

7 The multiple V-belt drive is anot example of engineering leaders Invented by Allis-Chalmers, to these power-saving belts drive of all U. S. machines *regardless what they produce!*

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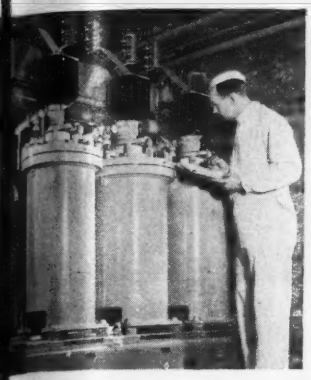
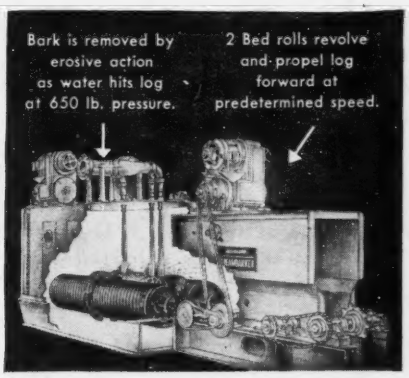
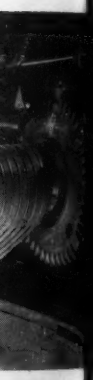


The answer was the Mercury Arc Rectifier — huge electronic device that reliably converts a-c to d-c current for electrolytic production of light metals. It was first introduced by Allis-Chalmers engineers!

3 Another electronic war development —*A-C's high-frequency Induction Heater*—greatly facilitates brazing, hardening and annealing of many small metal parts—saves time and work for metal-working industries!


Bark is removed by erosive action as water hits log at 650 lb. pressure.
2 Bed rolls revolve and propel log forward at predetermined speed.

4 To help relieve a paper shortage, A-C developed the Streambarker (unique machine using water pressure from power-operated pumps to strip bark from logs)—saved mills tons of precious wood pulp.



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In steel plants, "Regulex" Control, developed by A-C, helped boost output of alloy steel for war use—by automatically controlling electric furnace temperature, making possible extra "heats," lower "melt" costs.

9 Today, on A-C drawing-boards are plans that put these *and many other* A-C war products to work for peace —will help lower unit costs, produce better clothing, food, cars, home needs *by putting more power to work.*

10 Coming to every field: more efficient methods and equipment for generating, distributing and using electric power thanks to A-C engineering! Call your nearby A-C office.

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Cornell Society of Engineers

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"The objects of this Society are to promote the welfare of the College of Engineering at Cornell University, its graduates and former students and to establish a closer relationship between the college and the alumni."

Mr. Leinroth

President's Message

EARLIER in the year in one of these messages, I stated that the Society intended to intensify its efforts toward increasing its membership. Considerable thought has been given and work done in this direction and its encouraging to be able to report that our membership is now approximately 2100—over 400 more than at the same time last year, a gain of between twenty and twenty-five percent.

While this increase in membership is very gratifying, yet in it there is a point of weakness. We are not attracting enough of the younger graduates to membership in the Society, nor do enough of them attend our meetings and take an active part in them. While this weakness may be accentuated by the fact that most of the younger graduates were or are in the armed services yet the same general condition existed before the war. We were not and are not getting to the younger graduates—the observation has been made many times—and this poses a problem to which we should direct our attention. It is not a healthy condition and should be rectified.

It is important that these younger men become members and take an active part in the Society; it is important for the society and it is important for them. We need them and they need the Society; they have a definite contribution to make and, in turn, can take something away.

Contacts with fellow men are important; contacts with fellow engineering graduates from the same college are particularly important. They are most important to young men. Membership in the Society constitutes not only a help in maintaining their friendship with their contemporaries but also brings them in contact with the older and more experienced members.

Furthermore, it is important that they keep their contact with as many links as possible; it is good for them and good for the University and the College of Engineering. Membership in the Society constitutes one of these contact links.

With the war over the Society feels that it is important at this time to make a special effort to attract to the membership as large a number as possible of the younger graduates, many of whom are returning from the armed services to civilian life. It is hoped that our present members will apply themselves to that end.

As a special offer to the members of the graduating class of the College of Engineering, the Society now offers a membership in it for the first year following graduation free of charge to any member who requests it. We naturally hope that many will request it and that they will see the wisdom of continuing their membership after the first year. Through membership in the Society they will, among other things, receive the eight issues of the CORNELL ENGINEER which, we feel, they will enjoy and profit by reading. Besides the excellent technical articles which appear in it, the news of the College and Campus is brought home to them. We in the Society urge them to take advantage of this offer and thus maintain their contact with the College.

We of the Society wish at this time to cordially invite the younger graduates to membership. We want them to know that the Society is particularly interested in having the mas members and will welcome them as such most heartily.

J. PAUL LEINROTH

NUMBER 2 OF A SERIES

Newsworthy Notes for Engineers

Resistors dressed in carbon

Early in the war, shortages of high resistance wire finer than a human hair, threatened the output of radar, electrical gun directors and high-frequency radio equipment.

Calling upon experience gained in telephone work, Bell Laboratories and Western Electric engineers broke this bottleneck with deposited carbon resistors.

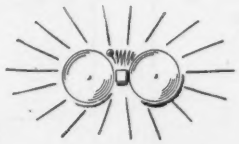
The base for one such resistor is a ceramic "pencil." This base slides through an automatic machine operated at high temperatures and receives a deposit of carbon film. Helical grooves are then cut in this film to provide a long, high-resistance path for the electric current.

Great savings resulted. For example: each 1-megohm deposited carbon resistor unit saves about one mile of wire, weighs about one-tenth as much and costs only one-twelfth as much as wire-wound units! In one war year, the saving was equivalent to more than 25,000 pounds of 46 gauge alloy wire.

Ringing the Bell on Reconversion!

One of the elements that makes the telephone ring is a pair of *ringer coils* —each coil 1½ inches long, tightly wound of 39 gauge copper wire. A horse hair is *thick* by comparison! So fine is this wire, that women with mechanical ability having fingers capable of fine needlework are selected to operate the complicated automatic machines which wind the coils, eight at a time, on one "stick."

Reconverting for production of ringer coils was one job for Western Electric production engineers. On the first Monday, exactly 80 coils—enough for only 40 telephones—were wound. On the fourth Monday, 8,232 coils were wound.



That's just one example of how production engineers have been ringing the bell on reconversion in making the 429 parts which go into the combined dial telephone set.

Prospecting for Mica in a Junk Heap

Until war put the clamps on shipping, mica from India held top place in the manufacture of capacitors used in radio circuits. As the shortage became acute, old methods of stamping out blanks by hand—which wasted a lot of mica—had to go.

Western Electric engineers attacked the problem of cutting down this wastage—devised a machine to hold the sheets of mica during punching.

This machine made possible the production of capacitor blanks from sheets of mica smaller than ever before usable—reduced scrap to a minimum. What's more, output soared—operators were less fatigued and worked more safely—inspectors found fewer imperfect blanks in each tray.

Manufacturing telephone and radio apparatus for the Bell System is Western Electric's primary job. It calls for engineers of many kinds—radio, electrical, mechanical, chemical, metallurgical. Many of the things they do —whether seemingly little or big—contribute greatly to the art of manufacture of communications equipment.

Western Electric

SOURCE OF SUPPLY FOR THE BELL SYSTEM

Inky

(*Continued from page* 16)

of Chemical Engineering and tenth term representative to that organization.

Those in the organic chemistry department know her as the human analytical lab. Her allergies to certain classes of organic compounds are as positive tests as are the standard procedures. Her senior research project is concerned with the decolorization of a wax.

We asked Inky about the kidding she has received. "No more than I deserved," was her spontaneous answer. Inky has, herself, a quiet, delightful wit and can undoubtedly hold her own in any situation. She believes that most of the antagonism directed towards women in school and in industry is prompted by feeling that they should on so many occasions be considered an exception to the rules.

Inez is interested in working with Patent Law and plans to take courses while working in Wilmington. She declined to say anything about other plans.

Ten semesters of Chemical Engineering without a term of rest! Five terms of holding a teaching assistantship along with a full academic load! Congratulations to the first women to go completely through the ten term Chem E course.

Al

(*Continued from page* 17)

sorority house on the hill takes a little of his time as well.

Al considers his life's ambition to be: "to sit leisurely in front of a roaring fire with a glass of beer in each hand, without a worry in the world." Al receives his degree in M.E. with an Aero. option at the end of this current term. His future for the next several months rests in the hands of the Navy Department, since he will be commissioned upon graduation along with the other eighth term Navy men. His personality and knack of winning friends are only some of the characteristics which will assure him success after he leaves Cornell.

Whit

(*Continued from page* 17)

gain an academic background but a feeling of maturity and confidence, social poise, and practical background. "One of the big disadvantages of the accelerated program as I see it is the fact that it prevents a student from gaining practical working experience during the summer."

In addition to his connection with the ENGINEER, Whit is recording secretary of the electrical engineering honorary, Eta Kappa Nu. He is also a member of the AIEE and Mesne. He started out as an ME, but he saw his mistake early enough to switch to EE in his third term. "Then I also made the mistake of getting into the communications option, but fortunately I was able to correct my error and switch to power."

Whit graduated with a BEE at the end of February. "Maybe I feel a little sorry to leave, but after eight terms straight it is rather a relief." He is now on sea duty as an Ensign in the Navy, but he hopes to return to civilian life one of these days and probably get a job in the electrical engineering field.

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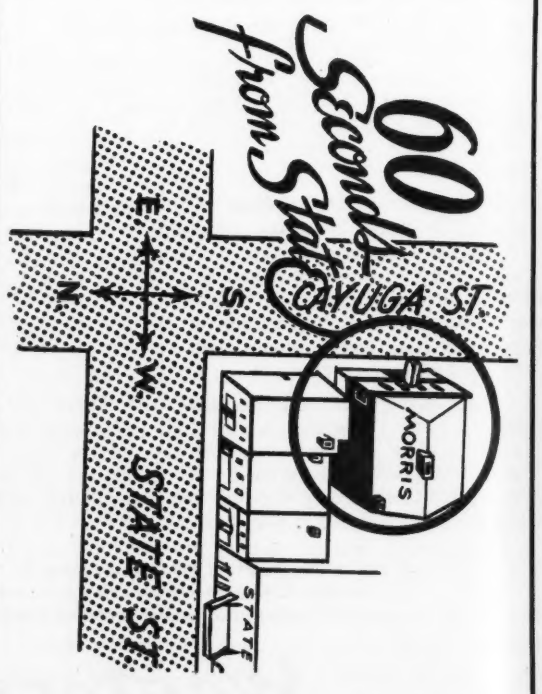

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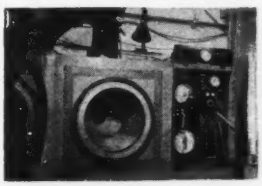
The Friez Instrument Division of Bendix Aviation Corp. calibrates Radiosondes in its plant at Towson, Md., with the test chamber shown below. This is cooled from + 104 to — 100 deg. F. in 75 minutes, the air pressure being simultaneously reduced to match flight conditions. Cooling is accurately controlled by a two-stage Frick refrigerating system using Freon-22.

The installation was designed and erected by the Paul J. Vincent Co., Frick Distributors at Baltimore.



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Franklin Institute

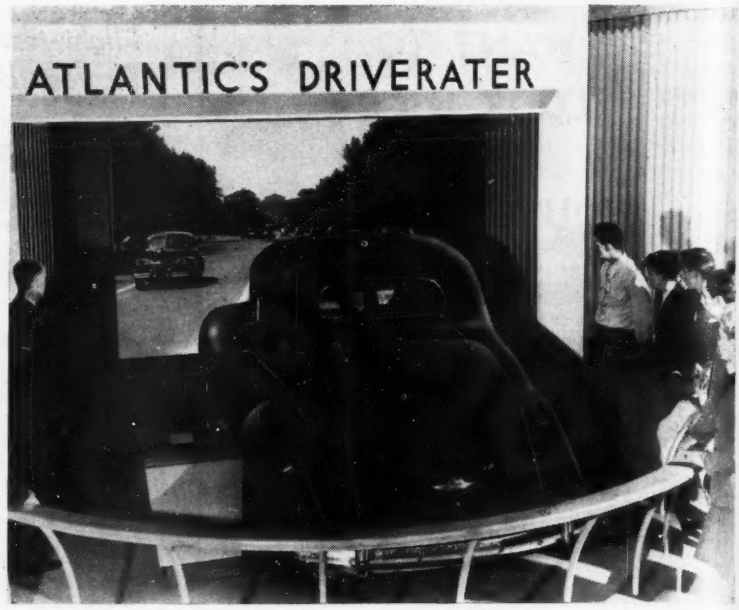
(*Continued from page* 15)

William Penn on the city hall. Each month a new demonstration is presented. Visitors to the Planetarium were able to view the stars as they appeared to their servicemen on Guadalcanal and the Philippines in the program "Stars Over the Pacific." The origins and development of "Calendars Old and New" were discussed during January, 1945. In the popular demonstration "Life on Other Worlds," highlights of the famous hair-raising Orson Welles broadcast of the "War of the Worlds" was presented by transcription from the original script, and the finest photographs from the great observatories added to the striking performance. On clear days and nights the planets may actually be observed in the Museum observatory.

Temporary Photo Exhibits

Many industries illustrate steps of manufacture or the uses of their products in temporary photographic exhibits at the Franklin Institute Museum. Last June the Electric Storage Battery Co. showed, through more than a hundred photographs, the different types of batteries from a pocketsize one used in research laboratory work to the gigantic submarine battery, which weighs more than two hundred tons and can lift its own weight about six miles high. The Bethlehem Steel Co., whose production averaged more than a ship a day for the past two years, included night scenes of its blast furnaces in its exhibit. A series of excellent photographs depicting laboratory techniques in organic chemistry, as used in the development of textile processing oils and chemicals were among those displayed by E. F. Houghton and Co. Some of the many corporations which have shown movies in the "Little Theatre," a part of the Museum, are the Atlantic Refining Co., Ford, R.C.A., Westinghouse, and the American Association of Railroads.

The Atlantic Refining Co.'s safe-driving exhibit, the Driverator, was opened on June 27, 1945, as the result of four years of effort to produce a device that would test a driver's ability by accurately simulating actual traffic problems. To test himself on this device, one drops a card into a slot, steps into a real automobile, and presses the starter button. Immediately a scene, as it would be viewed through the windshield of a moving car, appears on the screen. One's reactions to everyday traffic hazards (putting on the brakes, swerving to avoid a collision) are recorded automatically, and the scoring shows how one stands in such categories as color perception and reaction time. Although one might think that he could attain a perfect score by watching others take the test, and by anticipating from memory the various traffic situations which arise, it has been observed that memorizing the test almost invariably results in a low score.



The Driverator scores those tested according to their true driving ability.

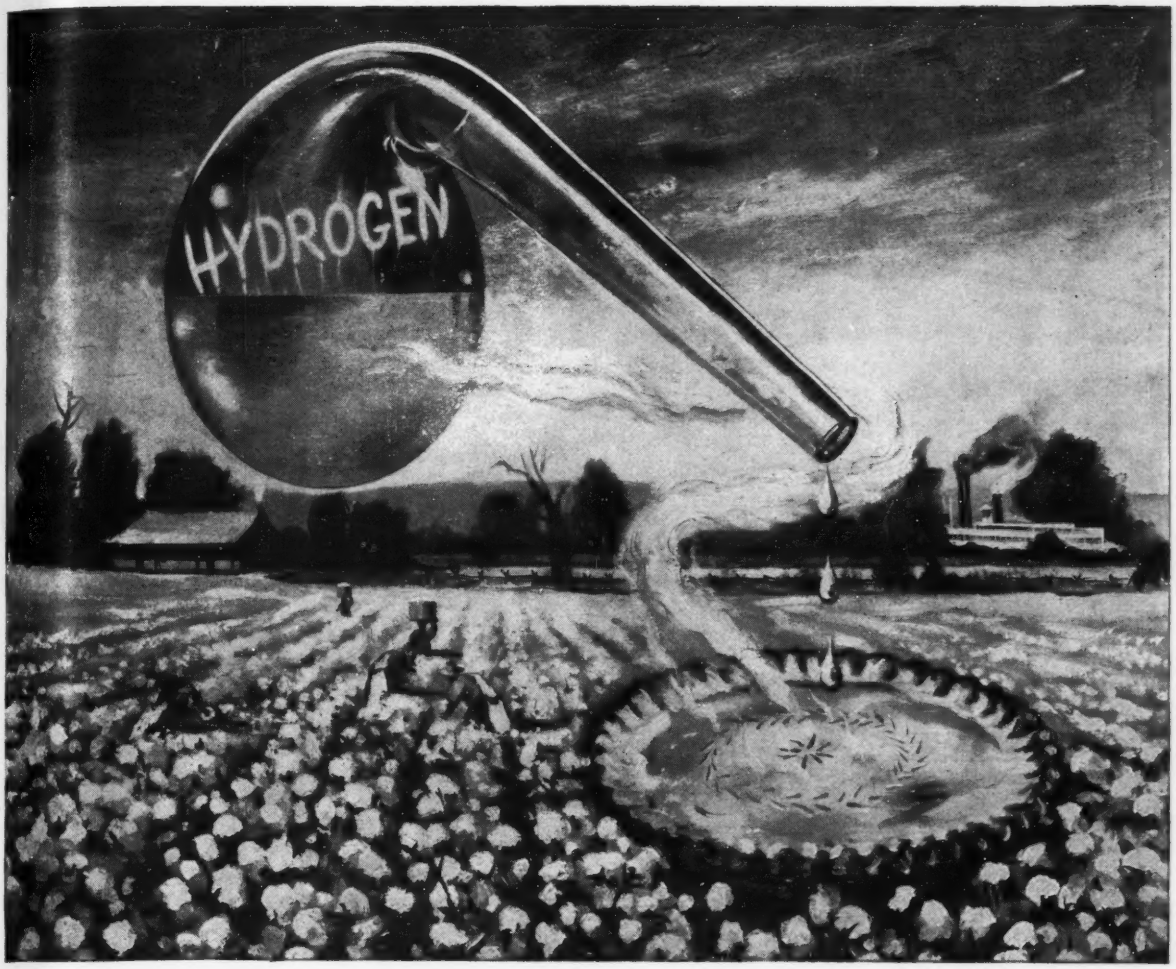
Naval Aviation Exhibit

Because of the current interest in aviation, a Naval Aviation Training Exhibit, designed by the Navy, has occupied several rooms on two floors of the Museum since July 9, 1945. Sailors, most of them beribboned veterans, conduct visitors through the exhibit and explain and demonstrate the various devices, for example, the flight engineer's panel of a PBM bomber covered with banks of dials, switches, signal lights, and levers, and the nearby instructor's panel, by means of which the instructor can simulate such conditions as the formation of ice on the wings for the student. The famous, long-secret Norden bombsight is included in the display of the horizontal and dead reckoning trainer. Motion picture equipment projects actual enemy territory below the replica of a bomber compartment. Visitors experience the thrills of a dogfight by sitting in the cockpit of the gun-airstructor, in front of which is a screen where an enemy plane, cloud banks, and horizon are projected. A Navy Operator directs the motions of the target; if the visitor successfully brings the plane into his gunsights and hits it, the image of the target turns red. A very popular feature with would-be pilots between thirteen and seventeen is the "Win Your Wings" Contest sponsored by the Institute and the Standard Oil Co. of Pennsylvania. Score is kept of each contestant's accuracy with the "Essowings" Link Pilot Trainer. The monthly winners are rewarded with an hour-long actual airplane flight, a pair of silver wings, and a Certificate of Achievement.

Atomic Bomb

Within a week after President Truman's announcement on August Sixth of the development and use of

(*Continued on page* 30)



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Franklin Institute

(*Continued from page* 28)

an atomic bomb, six special radio programs on atomic power were presented by representatives of the Institute, and these scientists were quoted in the newspapers and on the air. On August Seventh Major Coulson, Director of Museum Research, and Dr. Marshall, Director of the Fels Planetarium, presented over WCAU a program first given by them on July 13, 1940; in the original program they had predicted the imminence of the use of atomic power, explaining that the main obstacles to be surmounted were the scarcity of U235 and the difficulty of controlling an atomic explosion once it began. An atomic disintegration exhibit, including a diagram of the U235 atom and samples of uranium, radium, and the ores from which they are derived, was almost immediately installed in the Museum to satisfy public interest.

Each year seven medals are awarded to men of achievement by the Franklin Institute "to promote the development of science and the mechanic arts and to encourage invention." Professor Peter Debye, head of Cornell's chemistry department, was awarded the Franklin medal, the most coveted award of the Institute; on April 18, 1945, Dean Gilmore Clarke, College of Architecture at Cornell, received the Frank P. Brown Medal, "in consideration of his technical ability, foresight, initiative, and outstanding leadership in the field of town and city planning."

The Franklin Institute encourages scientific thinking by showing the public how science affects everyday living, by promoting greater efficiency and safety in industry, through research, and by honoring the noteworthy scientists for their success.

Alumni News

(*Continued from page* 19)

in minimum tactical delay or inconvenience to the armies."

ENSIGN R. Fitz Randolph, USNR, B.E.E. '46, is junior electrical division and engineering watch officer aboard the troop transport *USS J. Franklin Bell.*

HENRY M. Devereux, M.E. '33, on duty with Bureau of Ships, Wash., D. C., was promoted to commander USNR. He plans to stay with the navy.

PROFESSOR Byron E. Short, M.M.E. '36, is chairman of the department of mechanical engineering at the University of Texas in Austin.

SAMUEL T. BROWN, M.E. '17, has assumed duties as president of Virginia Iron, Coal & Coke Co.

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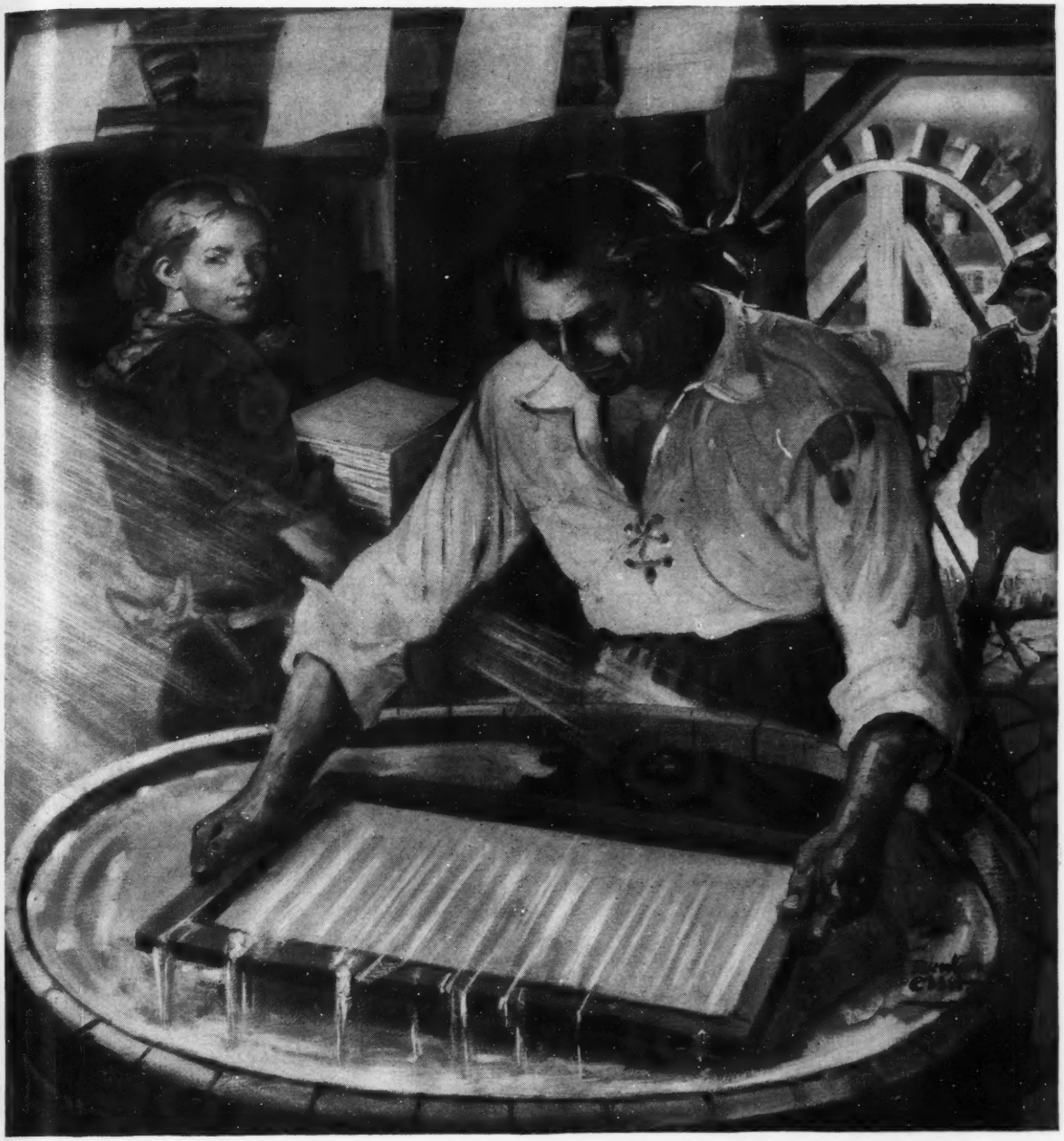
We are expecting, and getting, many registrations of Cornell veterans. They are welcome.



From Pulpit to Paper Mill

The first paper mill in America was built in 1690 by William Rittenhouse, a Mennonite preacher, from Amsterdam. The mill was situated on a little creek in what is now Fairmount Park in Philadelphia.

Linen rags — the product of flax which was raised in the vicinity — supplied the raw material, and the paper was said to be of excellent quality. Rittenhouse employed four men to do the work. The man in the picture is shaking pulp in a hand mold, forming the rough sheet of paper.

Today there are nearly a thousand mills in the country, producing annually more than 17 million tons of pulp and paper. The bearings they use . . . in their grinders, their cylinder molds, their press rolls, their driers . . . are in many cases supplied by SKF who pioneered in the paper industry. Mill executives and production engineers have come to rely more and more on SKF Anti-friction Bearings to improve efficiency and reduce operating costs.

Since SKF makes many types of ball and roller bearings, an SKF engineer can give you expert help in selecting

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Engineer and Labor

(*Continued from page* 13)

from union action, they have been granted the right to organize separately for collective bargaining purposes. In a heated dispute involving professional chemists working for the Gulf Refining Company, the chemists were recognized as a group separate from non-professional laboratory workers who belonged to the Federal Labor Union. An interesting case involving the aircraft industry was decided in favor of the professional engineers, working for Consolidated Aircraft, who sought to be excluded from a heterogeneous bargaining unit.

Moreover, in nearly all cases in which the professional groups failed to organize, the organized unions assumed professional employees' bargaining rights, in spite of the fact that these professionals did not belong to the union.

Nearly a decade ago, the need for individual bargaining groups appeared, but with a few exceptions, no action has been taken. Bernard A. Savage, past president of the Cornell Society of Engineers, recently said, "The more engineers are concerned in this matter of collective barganing, the sooner the issues involved will be settled." Younger engineers, in the "as-yet-not - firmly - established" group should be particularly interested in becoming acquainted with this labor situation. Undergraduates in engineering will find a thorough investigation of the facts to their advantage, since they will soon be confronted with employment problems. A review of the history of the movement may serve to illustrate its success.

Committee on Unionization

The American Society of Civil Engineers, in founding its Committee on Unionization in 1937, became the only one of the major engineering societies to take active measures toward the solution of this problem. This committee was formed in order to determine the extent to which engineers had been unionized, and to advise the society's Board of Direction on the proper action to be taken. When the Board met in January, 1938, the committee submitted an extensive report which was subsequently published in the March, 1938, issue of "Civil Engineering." Civil engineers, being in close affiliation with union workers, were among the first to feel the pressure of highly organized labor groups which sought the right to carry on collective bargaining for them.

Results of Report

After receiving the committee's report of April, 1942, following a long period of advisement, the Board authorized the Society's Staff to be of assistance wherever necessary. By July, two members of ASCE had requested that the society help to correct employment conditions on their respective projects. Howard Peckworth, who had been appointed as a staff member to study "engineer employer-employee problems," visited both projects and made extensive investigations. Meanwhile, many more requests were received, and Mr. Peckworth began a study of the laws and legal decisions involved in Labor relations of engineers.

In outlining several decisions of

(*Continued on page* 34)

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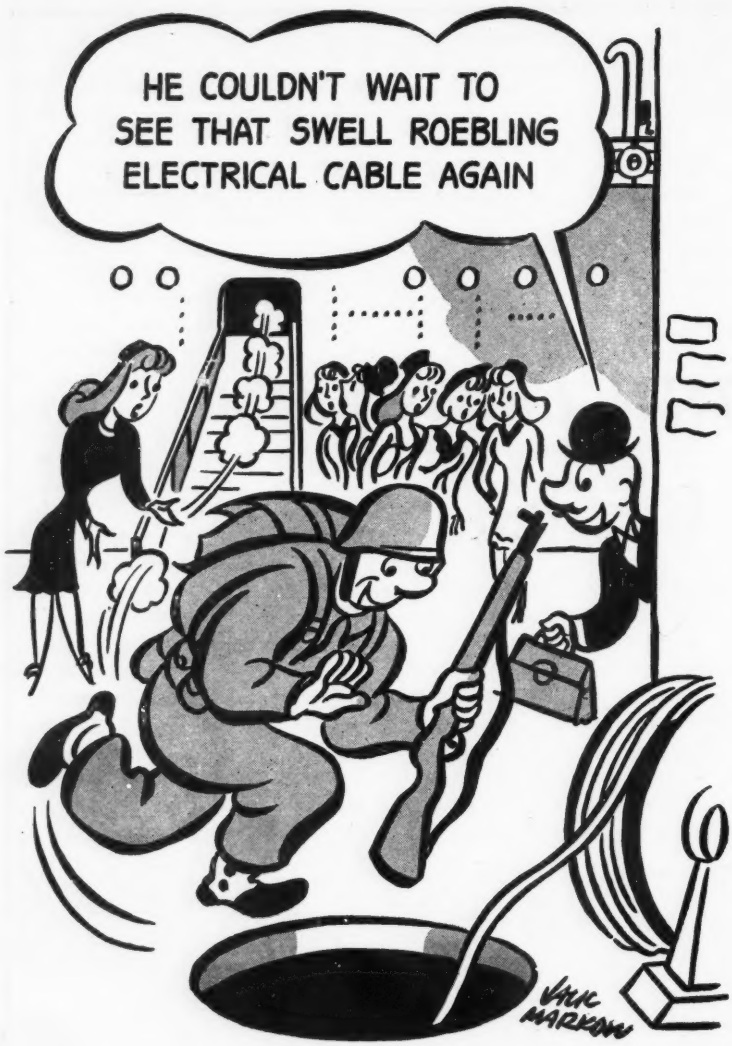

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COLD ROLLED STRIP • HIGH AND LOW CARBON ACID AND BASIC OPEN HEARTH STEELS
AIRCORD, SWAGED TERMINALS AND ASSEMBLIES • AERIAL WIRE ROPE SYSTEMS • ROUND
AND SHAPED WIRE • ELECTRICAL WIRES AND CABLES • WIRE CLOTH AND NETTING

Engineer and Labor

(*Continued from page* 32)

the National Labor Relations Board, Mr. Peckworth states three outstanding principles to which the Board held the majority of its decisions.

1. Professional Employees cannot be forced into heterogeneous labor groups against their own desire, but, on the other hand, they may form their own bargaining units.

2. Professional employees cannot be forced to join groups consisting mainly of workers engaged in routine technical work. Specially trained workers need not be grouped with ordinary employees.

3. When it is to be decided whether two or more distinctly separate groups of employees shall be organized in one unit, the desires of the groups are the determining factors. If a bargaining group splits as two organized parts, each is considered a labor organization and given the right to bargain for its members.

Legal Aspects

The major difficulty encountered in these decisions is that the term, "professional employee," is not adequately defined by the Wagner Act. However, the Fair Labor Standards Act sets forth the requirements of a professional employee. A professional employee is one who is engaged in varied intellectual work. His salary is $200 per month or greater. He has been previously trained in some specialized study, and, as a professional, exercises "constant discretion and judgment." Moreover, his output cannot be standardized.

In addition, the Peckworth report stated that the National Labor Relations Act makes no provision for employees of the local, state, and Federal governments. But conventional practice indicates that such employees may organize for bargaining purposes although they may not strike. These facts are particularly important in the case of Civil Engineers. Hundreds of Civil Engineers are employed by the government agencies on such projects as the TVA. On this project, engineers formed the Tennessee Valley

(*Continued on page* 36)

Have you heard about our "Glass Knees"?

THEY look like little knobby glass knees. But to a laboratory worker this jointed glass tubing is a real blessing.

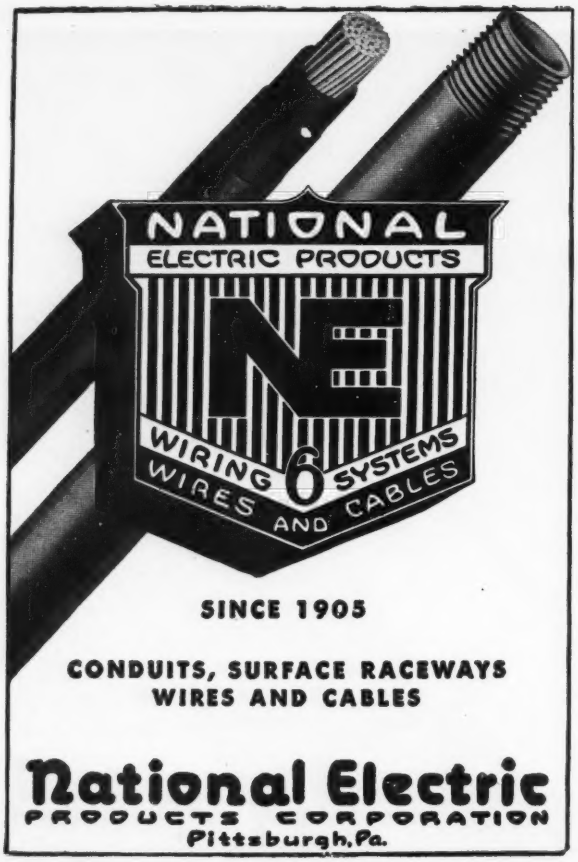
You've seen nightmare arrangements of glass tubing, flasks, and jars in "science" movies. Real laboratories have them, too. And the job of connecting a maze of tubing—with rigid glass joints that slip together like a fishing rod—is a tough one. Everything has to be lined up just right. And then a shock or a blow may break the rigid tubing and you have to start all over again!

So laboratory people weren't displeased when Corning came out with a tough leakproof ball and socket joint. It sets up and takes down easily. Parts are interchangeable, due to precision grinding. And it permits slight movements of the apparatus without leaking or breaking.

The answer to this glass problem was fairly easy. Others have been more difficult. The builders of the Lincoln Tunnel in New York wanted glass tiles for walls and ceilings that would reflect light but not glare and wouldn't catch dirt. A man in Berkeley, California, who was building the first "atom" smasher" asked for glass parts that could withstand the terrific heat of 8,500,000 electron volts. Chemical manufacturers needed piping that would resist the corrosive action of hot acids.

Corning research and manufacturing skill solved these glass problems. Keep this in mind wherever you wind up after school. It is entirely possible that the intelligent application of glass to many of your problems may lower costs and raise quality and performance. When the time comes, we'd like to help you find out. Corning Glass Works, Corning, New York.

CORNING
means
Research in Glass



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THE CORNELL CO-OP
Barnes Hall — On The Campus

Engineer and Labor

(*Continued from page* 34)

Authority Engineers' Association. The TVAEA joined with several other groups to form the Council of TVA Annual Employees, but the right to bargain for the type of employee in these other groups had already been granted to an A. F. of L. organization. Therefore, TVAEA withdrew from the Council and sought the sole right to bargain for engineers. The administration granted this right. This is only one example illustrating that engineers can organize successful bargaining groups which are exclusive enough to retain full professional standing.

Both Are Engineers

Perhaps even more important than the retention of professional standing is the improved relation between employer-engineer and employee-engineer. Through friendly panels, the employer and employee, both generally being engineers, find it valuable to "let down their back hair" and have an informal discussion of everything involved in the particular engineering task in which they are engaged. Through their representatives, employee-engineers may find the employer in his true light, rather than as the man symbolized by a letterhead or a pay check.

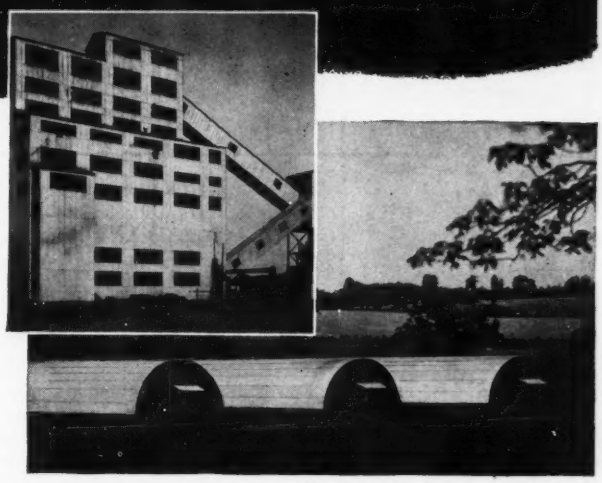
There are several rules which govern the formation of bargaining agencies. Employees undeniably have the right to unite for purposes of collective bargaining. Federal labor decisions will protect professional groups from domination by trade and labor groups, but the individual will not be legally recognized unless he is associated with a group having similar desires and interests. Bargaining groups, to be legal, need not be associated with organized labor. However, they must represent the desires of their members and be seriously interested in adjusting differences which exist between employer and employee.

These rules together with the experience of the last decade, lead to one general conclusion. The time has come for engineers everywhere, employers as well as employees, to realize the very present need for the organization of engineers' bargaining societies. The mode for such organization is open to much (probably heated) discussion, but the action of the A.S.C.E. points in the direction of the engineering societies. This method is not entirely mandatory; new organizations might serve as well. Indeed, some society members object very strenuously to the movement which appears to be transforming their society to a labor union. It is true that there will be some objectors. However it appears that these objectors are, in most instances, the less affected members.

Two Alternatives

Strong economic pressures are continually striving to force the engineer to organization, he now has before him two choices for his future course. He may throw his lot in with the organized labor of the country by joining a powerful national labor organization and thus sacrifice professional position for the possibility of higher wages. Or, he may form his own groups for the purpose of collective bargaining. Thus, having gained an opportunity to express his desires to his employer, he will have obtained a chance to further elevate his professional status.

It's the ZINC *that Stops the Rust!*



ALL credit to steel, a staunch and strong building material! It's worthy of the best protection you can give it—and the U. S. Bureau of Standards says ZINC is "by far the best protective metallic coating for rust-proofing iron and steel"... So long as steel is coated with zinc, it can not rust; and since the life of a zinc coating is *at least* proportional to its thickness, the heavier the coating, the longer it will protect the underlying steel.

Cut Costs! Save Material! Reduce Maintenance!... with ZINC

It is sound sense and simple economy to use zinc wherever possible for the protection of iron and steel—in buildings, in equipment, in machinery. Good design that includes zinc-protected steel will cut costs, not only in the original saving of material but also in subsequent maintenance. Heavy zinc coatings insure greater durability and longer service life—that is a demonstrated scientific fact; so for economy, *specify heavy coatings.* They cost but little more, yet pay enormous dividends in greatly increased durability and reduced maintenance costs.

Interesting and Valuable Information About Zinc

We want you to know more about zinc. Won't you please send us your name and address and let us mail you, without charge, these interesting and valuable booklets? Your address on a postal will do.

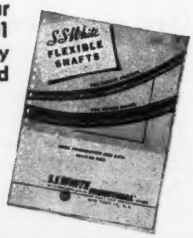
American Zinc Institute
INCORPORATED
60 East 42nd Street, New York 17, N.Y.

Try this FLEXIBLE SHAFT Quiz

To paraphrase a popular old ditty—another little quiz won't do you any harm. So, take a few minutes and test your knowledge of flexible shafts. Below are some basic questions. Cover up the answers and see what you can do with them.

WHAT ARE FLEXIBLE SHAFTS?	Flexible shafts are basic mechanical elements designed and made for transmitting rotational power around turns and in other cases where a solid shaft can't be used. They are built up practically solid of layers of strong wire, wound in a way that produces strength with flexibility.
ARE ALL FLEXIBLE SHAFTS ALIKE?	Far from it. They come in two classes – 1. for Power Drives – 2. for Remote Controls. Construction of the two classes is similar, but shafts differ in flexibility, torsional strength, torsional deflection and other characteristics to meet the requirements of their respective fields.
HOW BIG DO FLEXIBLE SHAFTS COME?	Power drive shafts come in diameters from .045" to .750". Remote control shafts from .130" to .437"
WHAT ADVANTAGES DO FLEXIBLE SHAFTS OFFER?	Flexible shafts reduce to a *single* element the number of parts required to transmit power or remote control between practically any two points. This eliminates gearing and simplifies manufacturing and lowers costs. Also, flexible shafts make possible better designs because they permit connected members to be placed wherever desirable to save space and to facilitate assembly, operation and servicing.
ARE FLEXIBLE SHAFTS RELIABLE?	For many years S. S. White flexible shafts, to the extent of millions of feet annually, have been serving in a wide variety of applications in aircraft, automobiles, radios, machine and portable tools, and a long list of other products. This is the best proof of their reliability.

AS AN ENGINEER you'll find it helpful to be familiar with flexible shafts and their possibilities. BULLETIN 4501 will give you basic facts and technical data. A free copy is yours for the asking. Please mention your college and course when you write.



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Railroads

(*Continued from page* 12)

portunity for the direct application of engineering training in the Transportation Department is in connection with the maximum utilization of locomotives.

However, railroads who have taken graduate engineers, Mechanical, Civil or Electrical, into their Transportation Departments have found that, given the right personality and other attributes, the training of the engineer peculiarly fits him to analyze the problems of the Transportation Department, to get the real reason why the thing happened, and to work out the proper plans to insure the most efficient and effective operation. For those who are particularly inclined toward Mechanical or Civil engineering details, some service in those departments is helpful even if the young engineer ultimately winds up in the Transportation Department. However, prior service in one of the other departments is not essential to success in the Transportation Department.

Summary

The important part that the railroads played in the mass movement of men and material in World War II is proof that the railroad is far from being an outmoded method of transportation. Without doubt some details of it have been outmoded and will be replaced by others representing advanced engineering.

To the young engineer who is not too certain as to what he wants to do, who has no marked preference for any particular kind of work and who is looking for the greatest immediate financial return, there are, no doubt, other opportunities which look better to him at the start.

But to the young engineer who is strong and healthy and not afraid of hard work, who has tenacity of purpose, who wants to get into a business where there is still much glamour and romance, where he can see the results of his labor and where the future is still wide open to him, and who likes to work with hard hitting men who know their business and who, as a rule, instinctively love it, the railroad business offers great attractions.

Industry Relies on COLUMBIA for Essential Chemicals

Columbia alkalies and related chemical products are essentials in processes employed by many basic industries . . . industries which supply countless needs of modern living.

SODA ASH	CAUSTIC ASH
CAUSTIC SODA	PHOSFLAKE (*bottle washer*)
LIQUID CHLORINE	SODA BRIQUETTES (*iron desulphurizer*)
CALCIUM CHLORIDE	CALCENE T (*precipitated calcium carbonate*)
SODIUM BICARBONATE	SILENE EF (*hydrated calcium silicate*)
MODIFIED SODAS	PITTCHLOR (*calcium hypochlorite*)

COLUMBIA CHEMICALS

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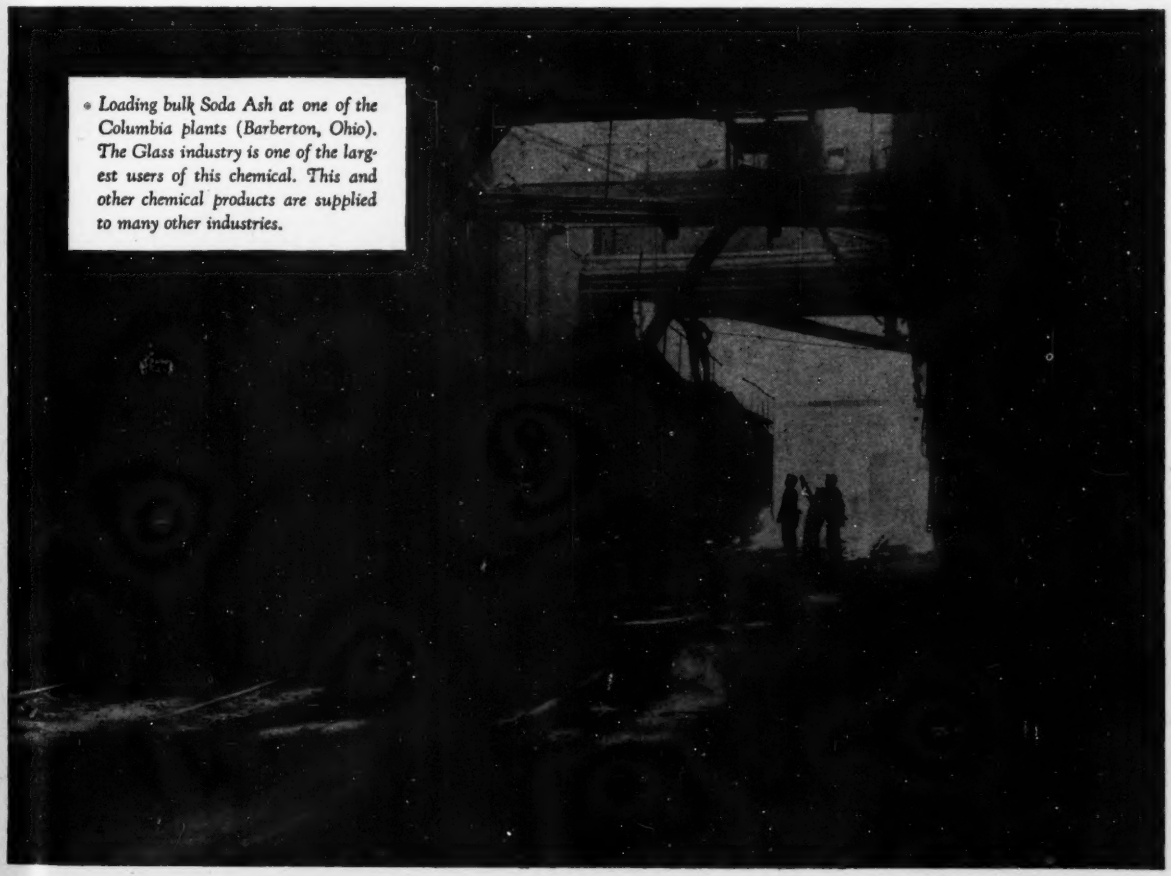
FIFTH AVENUE at BELLEFIELD • PITTSBURGH 13, PENNSYLVANIA

Chicago • Boston • St. Louis • Pittsburgh • New York • Cincinnati • Cleveland • Philadelphia • Minneapolis • Charlotte • San Francisco



• *Loading bulk Soda Ash at one of the Columbia plants (Barberton, Ohio). The Glass industry is one of the largest users of this chemical. This and other chemical products are supplied to many other industries.*

Aero Lab

(*Continued from page* 9)

variable speed model aircraft propellers. This shop also does aircraft sheet metal work. It has provisions for plastic fabrication, pattern work in wood or metal, and is set up for experimental machine shop work and machine engraving. In addition to being equipped with the finest tools, machines and facilities available, the Shop has a highly trained staff of skilled mechanics. These men have done much of the machine work for the new, variable-density, high speed wind tunnel and special equipment for the Laboratory's altitude chamber.

Information Center

The Library is the information center of the Laboratory, distributing such information to all personnel as may pertain to the work being done, or answering requests as new problems arise. A small, but well-rounded and carefully selected, book collection, together with a rather extensive group of reports and periodicals, all with detailed subject cataloging, enables the Library staff to compile information as needed. Preparation of bibliographies and translations, editorial assistance, distribution of Laboratory publications, and routing of reports of periodical material on specific subjects to individuals are among the services given. A calendar of society meetings, as well as the agenda and reprints of papers, is maintained.

Tests in the high-altitude chamber.

The second Laboratory building consists of about 86,000 square feet in a large hangar structure, located directly upon the Buffalo Municipal Airport, which was constructed in 1944. In this location are housed the Flight Research Department, about half of the Physics Department activities and the Development Division of the Laboratory which consists of the Experimental Engineering, Armament, and Manufacturing Departments.

The Flight Research Department is engaged in the measurement and study of aerodynamic forces on the airplane in flight. It specializes in flying laboratories, and has several elaborately instrumented aircraft in flying status. Flutter and buffeting are studied in flight, not only to solve current problems but to form the background and foundation for attacking the more subtle irregularities encountered as supersonic speeds are approached. Methods have been developed whereby flutter and vibration can be induced well below the critical speed. This is accomplished by loading the air-

(*Continued on page* 42)

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•

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REFRACTORY CRUCIBLES
HIGH-TEMPERATURE CEMENTS
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WHO IS THE LOVELIEST LADY YOU KNOW?

YOUR SWEETHEART? Your sister? Is she someone you know well . . . or someone glimpsed fleetingly in a crowd? Is she blonde or brunette or titian? A movie star, perhaps?

Whoever she is, the chances are that a little black lump of coal has helped to make her beautiful!

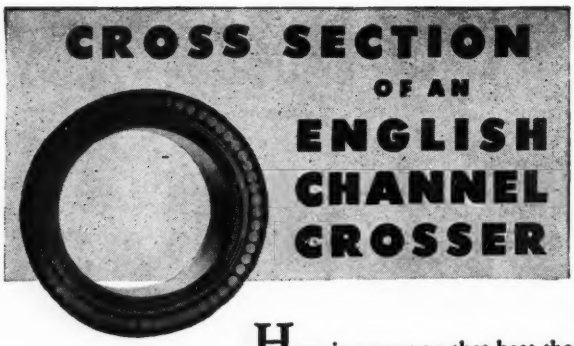
For these days, many of her cosmetics contain derivatives from coal—in colorful dyes and delicate fragrances. Lipstick to harmonize with her coloring. Tinted face powder. Rouge. Eye-shadow. Nail polish.

Helping to create beauty is just one of the jobs coal does. Derivatives from coal also are helping to cure the sick, to grow better garden crops, to make plastics, paints, lacquers, to drive airplanes and stoke blast furnaces. In fact, you'd have to search long and hard to find a more versatile performer than a little lump of coal.

For a long time now, Koppers chemists have been studying coal, experimenting with it, making useful chemicals from it. And today, Koppers is producing, in commercial quantities, scores of chemicals for manufacturers to use in finished products of all kinds.

In addition to having a thorough knowledge of the chemistry of coal, Koppers also designs and builds coke ovens, treats wood with preservatives, manufactures piston rings, couplings, airplane propellers, roofing and paving materials, and engages in numerous other activities besides. That's why Koppers is known as "the industry that serves all industry". Koppers Company, Inc., Pittsburgh 19, Pa.

The industry that serves all industry . . . KOPPERS



Here is a weapon that beat the Wehrmacht, a cross section view of the submarine "cable" that piped oil from Great Britain to the Allied forces on the European mainland. Paid out from huge coils in the holds of ships, more than 20 flexible pipelines were laid under the English Channel.

As the picture indicates, this "cable" comprises a lead alloy tube, steel reinforcing tapes, steel wire armor and jute wrappings. It's actually a submarine cable except there's no core. Oil flows in the space normally occupied by the electrical conductors.

The Okonite-Callender Cable Company was one of four American wire and cable manufacturers who together turned out 140 nautical miles of this pipeline. Experience in working with others to solve special manufacturing problems is combined at Okonite with years of research and development work in electrical wire and cable improvement. The Okonite Company, Passaic, New Jersey.

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Tutoring in university courses that is effective because directed to individual needs.

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C. M. DOYLE '02, *Headmaster*

Aero Lab

(*Continued from page* 40)

plane at locations that lower its natural frequency and then exciting by means of vibrators. With the present instrumentation these aerodynamic forces and loads can be measured by the air-borne equipment with the results directly photographed in the test airplane or telemetered by radio and television to a mobile receiving unit on the ground. An extensive program is under way on a basic and quantitative study of the problems of stability and control, utilizing an automatic pilot for the control of appropriate maneuvers.

Armament Department

The Armament Department is engaged, primarily, in the design, development and testing of the many new devices for military aircraft which fall into the broad classification of armament. It is also engaged in the development of specialty items which represent advances in specialty tools or manufacturing equipment. This department is responsible for the conception, design engineering, initial fabrication and testing of these specialty items.

The products of this department have included a new power-operated gun turret, a bomb-adapter, torpedo depth setter, a system for producing inert gas for the vapor space of fuel tanks, an automatic cable cutter which fuses cable-ends to prevent fraying, and a soldering "gun" which greatly reduces the time required for soldering electrical connections.

The Pilot Manufacturing Shop has as its prime function the production of working proto-types of devices which arise from the research activities. Such production, followed by adequate evaluation and testing, is an integral and essential part of any realistic development program. This shop is completely equipped with the various tools and equipment required for versatile and often complicated small-scale manufacturing activities.

Development Engineering handles the production design for the pilot manufacturing shop and maintains coordination between various research groups working on problems connected with projects that require the ultimate design and production of a number of test items. This group of highly experienced engineers handles the transition from research to development of a design readily adapted to manufacture. For the time being the work of this department is of a confidential nature that cannot be discussed for reasons of national security.

Recapitulation

The above exposition constitutes a hasty and inadequate birds-eye view (or perhaps more appropriately, airplane view) of the facilities and activities of the newest addition to Cornell engineering. It is the hope of the Director that this Laboratory can rapidly establish itself as a significant factor in the advancement of both education and industry and will be an institution to which all Cornellians, students and alumni alike, can point with pride.

RCA Laboratories provides another great achievement in television—the "mirror-backed" Kinescope, or picture tube.

New "searchlight brilliance" for home television!

Now, large screen television pictures are twice as bright—yes, *twice as bright* as ever before!

You can "count every eyelash" in the close-ups. You'll almost want to shake hands with the people on your television screen—so great is the illusion that they are actually in your living room.

This new sharpness and brilliance is achieved through the new RCA "mirror-backed" Kinescope, or picture tube, perfected at RCA Laboratories.

It has a metallic film—eight-millionths of an inch thick. This metallic film acts as a reflector, allowing electrons to pass through to the screen but preventing light rays from becoming lost through the back of the tube. Just as the reflector of a searchlight concentrates its beam—so does this metallic film reflector double the brilliance and clarity of detail in home television receivers.

Similar progress-making research at RCA Laboratories is being applied constantly to all RCA Victor products—assuring you that anything you buy bearing the RCA monogram is one of the finest instruments of its kind science has achieved.

. . .

Radio Corporation of America, RCA Building, Radio City, New York 20. Listen to The RCA Victor Show, Sundays, 4:30 P.M., Eastern Time, over the NBC Network.

RCA Victor home television receivers will be available in two types. One model will have a direct-viewing screen about 6 by 8 inches. The other type will be similar to the set shown above—with a screen about 15 by 20 inches. Both instruments are being readied for the public with all possible speed and should be available this year.

RADIO CORPORATION of AMERICA

STRESS and STRAIN...

Rastus had been operating an elevator for thirty years, but this was absolutely the first time that anybody had ever tried to enter it leading a cow. "You can't bring that cow in here," said Rastus indignantly.

"Please," begged the man, "I've simply got to take her up in the elevator."

"You do," said Rastus, "Why?"

"Because," said the man, "she always gets sick on the escalator."

* * *

A Scotchman was taking his small son for a walk. Suddenly he said thoughtfully, "Sandy, have you got your Sunday boots on?"

"Aye, father," was the reply.

"Well then, take longer steps."

* * *

Wife: "I'll never go anywhere with you again as long as I live."

Husband: "Why—what have I done now?"

Wife: "You asked Mrs. Smith how her husband was standing the heat, and he's been dead two months."

* * *

Arts Frosh: "Yes, this is a nice little apartment, but I don't see any bath."

Landlady: "Oh, pardon me! I thought you were one of those engineering students."

* * *

DEFINITIONS:

Middle age—that period of a man's life when he would rather not have a good time than have to get over one.

Echo—the only thing that can deprive a woman of the last word.

A real executive—a man who can hand back a letter for the third typing to a red-headed stenographer.

Puppy love—a prelude to a dog's life.

Hotel—a place where guests give up good dollars for poor quarters.

Imagination—something that sits up with a wife when her husband is out late.

Student: "Ah, professor, I hear your wife has had twins. Boys or girls?"

Professor: (absent-minded): "Well, I believe one is a girl, and one is a boy, but it may be the other way around."

* * *

First Engineer: "Let's cut mechanics today."

Second Engineer: "Can't. I need the sleep."

* * *

Two flies were watching another fly stagger around on a table top.

First fly: "Looks like he's drunk."

Second fly: "Yeh, he's got the DDT'S all right!"

* * *

Sailor: "You aren't getting seasick, are you?"

V-12: "Not exactly, but I'd sure hate to yawn."

* * *

A man in an insane asylum sat fishing over a flowerbed. A visitor approached, and wishing to be affable remarked, "How many have you caught?"

"You're the ninth," was the reply.

* * *

"Ah wins."

"What you got?"

"Three aces."

"No you don't. Ah wins."

"What you got?"

"Two eights and a razor."

"You sho do. How cum you so lucky?"

* * *

In moonshine districts, where the whiskey looks like water and is drunk like water, strange ideas prevail as to what intoxication really is. In a village one Sunday afternoon a man lay in the boiling sun in the middle of the road with an empty bottle by his side.

"He's drunk; lock him up," the sheriff said. But a woman interposed hastily.

"No, he ain't drunk, she said. "I jest seen his fingers move."

"Sorry to have kept you waiting, but I've been setting a trap for my wife."

"Good Lord, man, what do you suspect?"

"A mouse in the kitchen."

* * *

No man likes to be beaten to the punch, especially if it's filled with gin.

* * *

First V-12: "How do you stand that coffee they serve at the mess-hall?"

Second V-12: "Easy, I take a teaspoonful of Drano every day."

* * *

"I've cured my husband of coming in late at night."

'How?"

"When he comes in, I call to him, 'Is that you, Bill?' "

"How does that cure him?"

"My husband's name is Jack."

* * *

A freshman was about to eat at a campus restaurant and asked if they had the regular $2.00 dinner. "Sure," said the waitress, "on white or rye?"

* * *

Irate parent (shaking stick): "I'll teach you to make love to my daughter, young man."

Suitor: "I wish you would, sir, for I don't seem to be making very much headway."

* * *

We know a man who is so lazy that he married a widow with five children.

* * *

Only the men complain of the cold. A woman can always put another ribbon in her hair.

* * *

Katz: "Now watch the blackboard while I run through it again."

* * *

"I had to run into a fence to avoid hitting a cow standing in the road," the lady motorist explained to the judge.

"Was it a Jersey cow?" he asked.

"I wouldn't know," she replied. "I didn't see its license plate."